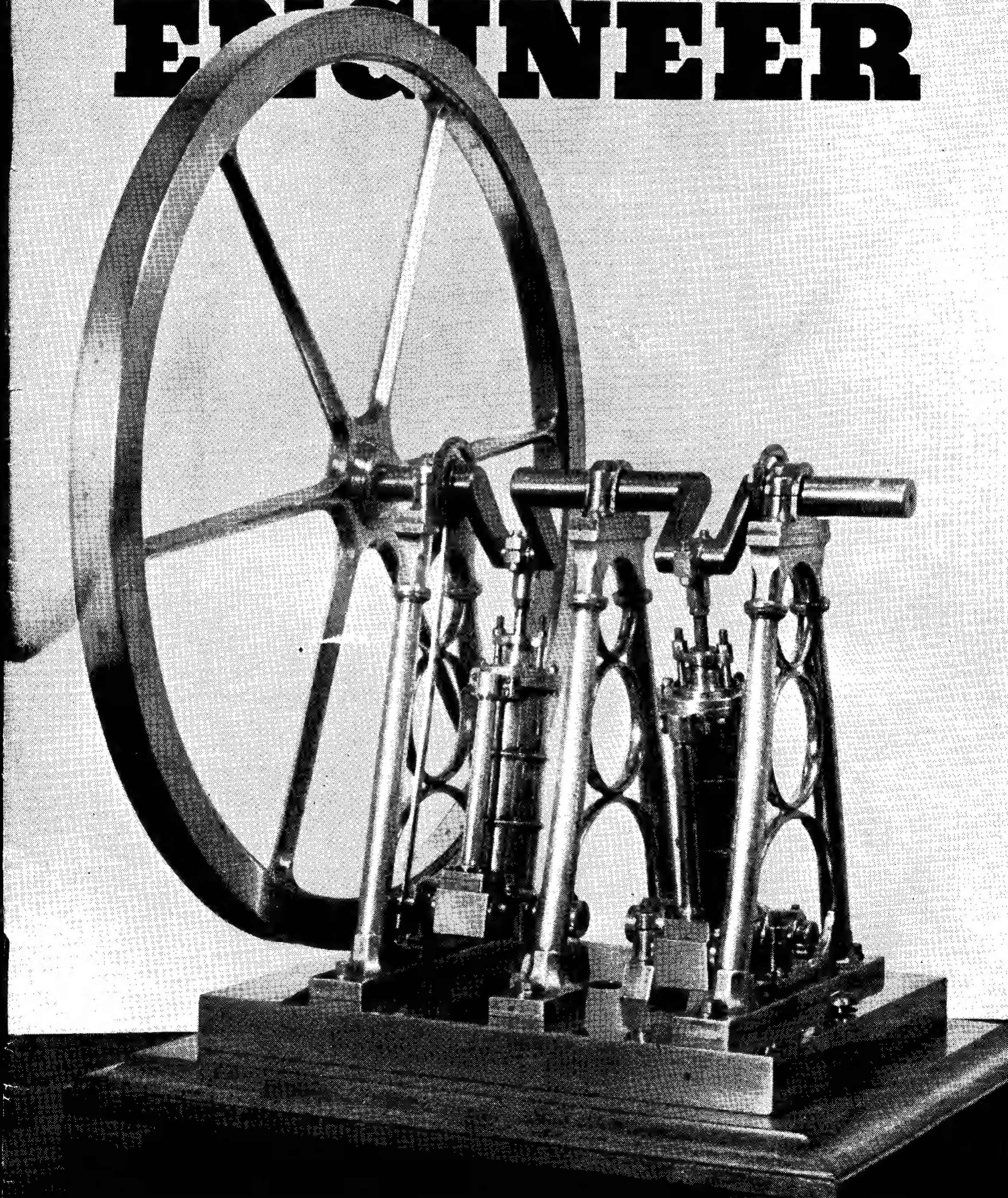
THE MODEL ENGINEER



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The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

1ST DECEMBER, 1949 VOL. 101 NO. 2532

SMOKE RINGS

A New Feature

● THE WELCOME relaxations which, in recent months, have taken place in the control of paper supplies have made it possible for us to do much towards satisfying the ever-present demand for "Ours." We are now in a position to ensure that every reader who places a firm order with his newsagent, or becomes a regular subscriber, shall receive his weekly copy without fail.

At the same time, consideration is always being given to ways and means of widening the scope and variety, as well as the usefulness of the material we offer in our pages. Possible new features are always being discussed, and in the event of further increases of paper supplies, we may revive one or two of our older features which proved extremely popular before the war.

In the very near future, we shall be introducing a series of test reports on equipment offered by our advertisers; the result of the announcement, some time ago, that we intended to do this met with an excellent response which ensures the success of our venture.

In addition to this, and to show that we are fully cognisant of the fact that the beginner is ever with us, we shall be publishing on the 22nd of this month, the first article of an indefinite series under the general heading of "The Novice's Corner." These articles have been planned with the object of offering advice and help to anybody who is taking up model engineering for the first time.

Our programme, as usual, is to do everything we can to help the reader to get the best out of the hobby. But the reader can also play his part; and one of the best ways he can do so is by finding at least one new recruit to the hobby. Each new recruit is a potential new reader of "Ours," and we will see that copies are available to meet an increased demand.

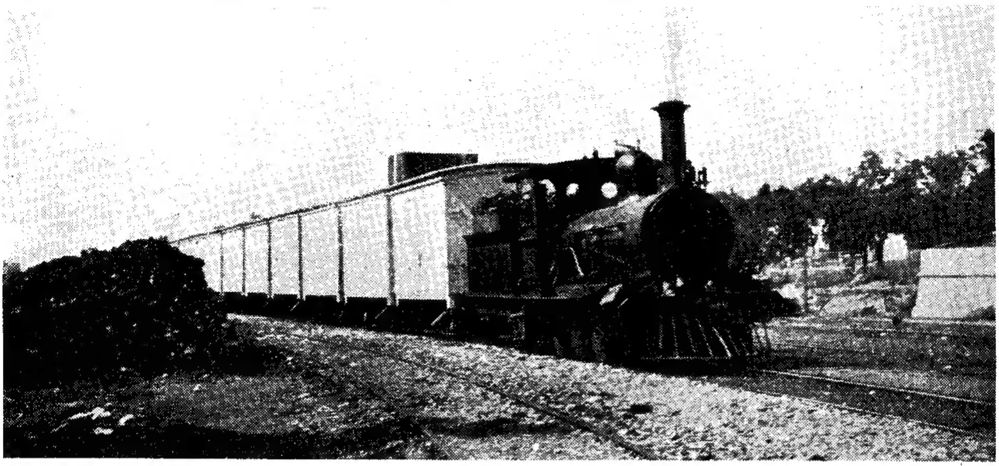
Incidentally, with the Christmas season now not far away, we would suggest that an admirable present for your son, godson, nephew, or young friend would be a year's subscription to THE MODEL ENGINEER.

Frequencies for Radio-controlled Models

● OUR ATTENTION has been drawn to an error which appeared in the letter published in the November 10th issue from Mr. W. H. C. Taylor, who gave 465 to 465.5 megacycles for the upper band. The G.P.O. informs us that this should be 464 to 465 megacycles. The lower band is, as correctly stated by Mr. Taylor, 26.96 to 27.28 megacycles.

Beyer-Peacock Locomotives

● MR. JOHN WILSON, an Australian reader, has sent us a very interesting letter arising out of Mr. F. C. Hambleton's drawing of the Beyer-Peacock saddle-tank locomotive, published in our issue of May 19th, last. Mr. Hambleton mentioned that the subject of his drawing was



built in 1876 and survived until last year. Mr. Wilson states that in the Northern Territory of Australia a Beyer-Peacock locomotive built in 1877 is, so far as he is aware, still running. He goes on: "During the war, this engine did a tremendous job, running practically day and night with next to no repair work. As 'L.B.S.C.' remarked recently, they built engines in those days! Two years ago, I built a scale plate (exhibition) model of this locomotive. The photograph I am enclosing was taken in 1926, when I was in the Territory myself. At that time, the train she hauled was known as 'Leaping Lena,' a name changed to 'The Spirit of Protest,' which is a soldier's pun on the 'Spirit of Progress,' Victoria's crack train. The name of the engine was *Sentinel*."

The engine is a 2-6-0 with outside cylinders and a 4-wheeled tender; she is typical of many built by Beyer-Peacock for the Australian railways about 70 years ago, and we are very interested to note that the photograph shows very little evidence of any alterations.

Refrigerator Construction

● IN RESPONSE to innumerable requests from readers for information on the construction of a domestic refrigerator, we are publishing in this issue the first of a series of articles on this subject, written by a contributor with practical experience, who has actually built and used the machine described. We have, on several previous occasions, published constructional articles on this subject, one of which, written some years ago by Mr. Meyland Smith, has been followed with success by many readers, but information on the subject is constantly in demand by new readers. Although it might be argued that refrigerator construction is not truly model engineering, it is interesting work, well within the capacity of the home workshop, and of undoubted utility when completed. Moreover, it gives scope for the model engineer to demonstrate the usefulness of his craft to the domestic powers, and the product, by enhancing home comfort and easing the burden of the housewife, is universally welcomed. Some readers may think it incongruous to be talking of refrigerators in December, but it will be clear that this is really the best time to get going on a project of this nature, so that it may be completed and tested in time for the return of summer—which, if it follows the pattern of the past season's weather, will certainly make everyone refrigerator-conscious!

Models at Warrington

● THE FIRST exhibition of the Warrington Society was held in the Heathside School and opened by His Worship the Mayor of Warrington (Councillor W. Higham). The doors were open for one and a half days and two evenings—a total time of twenty-four hours—during which period one thousand, eight hundred people were admitted.

A great variety of models were on show, and on the passenger-carrying track Mr. Kenwright did yeoman service with his $3\frac{1}{2}$-in. gauge Adams L.S.W.R. 4-4-0. Considering that this locomotive was completed a week previous to the exhibition, it came through the ordeal of twenty-one hours of hauling with flying colours, and reflects great credit on her builder.

Mr. Hodson's "OO" gauge layout was also a centre of attraction for both young and old. A number of models were working by means of compressed air and proved to be a source of interest to all. Neighbouring clubs, viz. Liverpool, Manchester, Preston, Rochdale and many lone hands gave valuable aid by loaning models.

The members of the club tender their sincere thanks to all who lent exhibits and to those who worked to make the exhibition a success, especially to their worthy secretary, Mr. P. Clayton.

A Domestic Refrigerator

by L. C. Sherrell

I HAVE been asked by the Editor to write this article to enable any "M.E." readers who might feel so disposed to build themselves a refrigerator. Mr. Meyland Smith described a sulphur dioxide unit a few years ago, and I decided to make the cabinet more or less the same, but to use methyl chloride as a refrigerant. For the benefit of any new readers I will provide the necessary drawings for the complete unit. The specifications are as follows :—

4½ cu. ft. capacity, 7½ sq. ft. of shelving space, and 54 ice cubes (I have found this to be quite large enough for Mr. Strachey's allocations). With the room temperature at 70 deg. F., the compressor will run eleven or twelve minutes out of each hour for maximum cold, which, I believe, compares quite favourably with this type of commercial refrigerator.

7½ sq. ft. of shelving space

Before I start, I want to make it quite clear that I do not claim to be an authority on refrigeration, but if anyone cares to have a shot at making one as I set it out, I see no reason why it should not give complete satisfaction.

It will be as well at this stage to run briefly through the principles of mechanical refrigeration.

The refrigerating liquid flows under pressure through a metering valve, commonly called an expansion valve (which can be adjusted to maintain a predetermined pressure) to the evaporator where the pressure is relieved causing the liquid to expand into a gas, thus absorbing any heat there might be in the cabinet. This low-pressure gas is then sucked out of the evaporator into the crankcase of the compressor where it is passed through a valve in the piston to be compressed into a dense gas, containing not only the heat it absorbed in the evaporator, but the added heat of compression which, of course, increases the temperature to roughly 25 deg. F. *above* the room temperature. This hot dense gas is then forced out of the compressor, through the condenser where it is cooled and gives up its heat reverting to a liquid, and flows into the liquid container, and so on again to the evaporator, until the temperature within the cabinet is lowered sufficiently to enable the evaporator to frost up and chill the bulb of the cold control switch which will in turn automatically switch off the motor.

From the foregoing it will be seen that refrigeration is not intrusion of cold, but absorption of heat. If you now take a look at the diagram, you will see what has to be achieved for successful operation.

The question of a suitable refrigerant now arises. There are three which can be used in this type of machine, it being necessary to adjust the speed of the compressor to suit the particular refrigerant ; it may be of interest to mention them.

Sulphur dioxide (SO_2) with a boiling point of 14 deg. F., has splendid lubricating qualities, but this, I think, is outweighed by its disadvantages : i.e., its corrosive effect on metals in the presence of moisture and the smell it makes if there are any leaks.

Freon 12, possibly is the best, the boiling point being as low as minus 21 deg. F., but I understand at the moment it is unobtainable. However, we have a good substitute in methyl chloride (CH_3 CL), boiling point minus 11 deg. F. It is easy to obtain, and at a price that won't hurt us. This gas has a slight sweet-smelling odour, and as it has anaesthetical properties it

should not be inhaled in large quantities. It is also inflammable, so don't test for leaks with a naked flame. Aluminium joints or joint rings containing graphite must not be used, as they are affected by this gas.

enough for arc welding, the gas welders will require a 500 litre jet or its equivalent. The amateurs had better bronze-weld, but whichever method is used there must be no slag inclusion, no blowholes, no almond rock, and, most im-

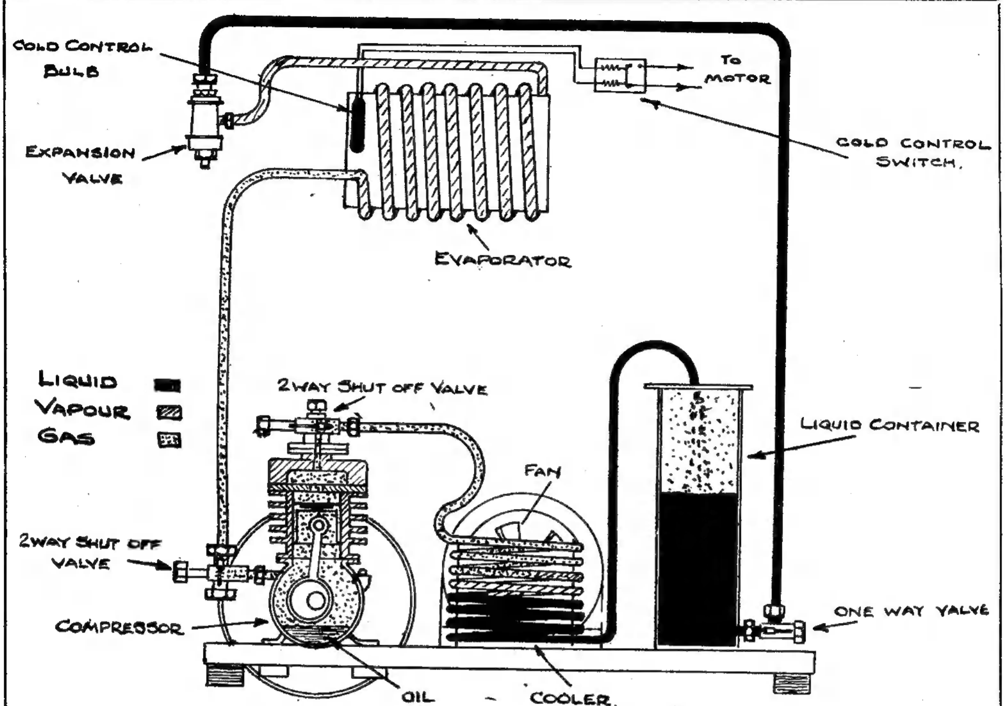


Diagram of the system

The Compressor, $1\frac{1}{2}$ in. Bore and Stroke. Fig. 1

The compressor, being the toughest nut to crack, had better be the first job. As this will be the heart of the machine, the better the job you make of it the longer will be its life, and the quieter and smoother it will run. I have experimented with big-ends and eccentric drives, phosphor-bronze and white metal sleeve bearings, and being handicapped all the time by the fact that the crankcase has to be kept down in size to enable it to be machined on the average model engineer's lathe, by far the best results were obtained by making it a complete ball-bearing job. While I admit it will entail a lot of work, I can assure you it runs as near silent as is possible.

The Crankcase

This is fabricated from a piece of 5-in. mild-steel tube, $2\frac{1}{2}$ in. long, faced up each side to finish $2\frac{3}{8}$ in. Two $\frac{1}{4}$-in. mild-steel plates, 5 in. diameter, with hole cut in centre, approx. $2\frac{3}{4}$ in., are then pressed in $\frac{1}{8}$ in. each side and welded. Number 10 electrodes are heavy portant, no leaks. The holding-down angles, which are drilled first, go on next. Stand the crankcase on its rim on a flat surface, and tack one on each side as shown on drawing, check for alignment and weld. Now drill two $\frac{3}{8}$-in. holes in the rim as shown, one for the oil filler plug, and the other for the suction flanged-piece. Cut a $\frac{1}{8}$-in. gas socket to the desired bevel and weld on, next make two flanged-pieces, one for the suction which can now be put on, the other for the discharge. To facilitate machining operations it will be necessary at this stage to set up in the four-jawed chuck and face the holding-down feet. You will only be able to grip with two opposed jaws, so bring the tailstock up, and with a small bronze pad to protect the centre, it can be supported whilst light skims are taken across the two feet. It may now be bolted through the feet on to the faceplate, and bang in the centre of the rim bore out to $1\frac{5}{8}$ in. diameter, face across to make a flat platform to receive the 3-in. $\times$ $\frac{1}{4}$ in. cylinder holding-down flange which is also bored to $1\frac{5}{8}$ in., clamp one on top of the other and weld, bolt it back on the faceplate, setting the bore to run true, and bore

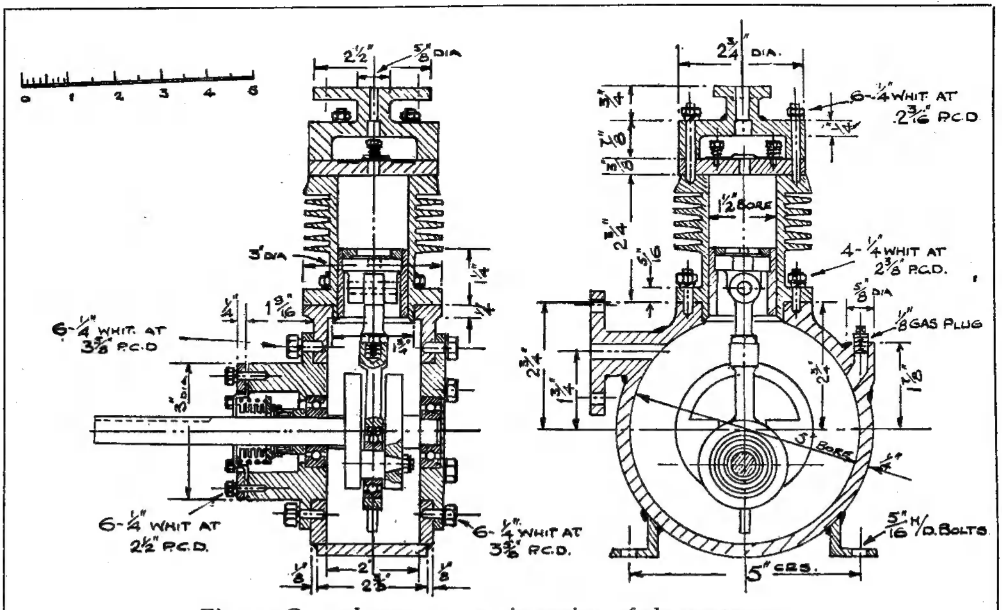


Fig. 1. *General arrangement, in section, of the compressor*

out to $1\frac{3}{4}$ in. diameter. At the same setting face across just to clean up.

Mark out the 3 in. bore on one of the side plates and bolt through the feet on to an angle-plate, setting to run true by the previously scribed circle, and bore through both plates to this diameter, take a skim across face to clean up to a diameter of $4\frac{3}{8}$ in. The other side will have to be faced by clipping back on a stub mandrel. A lot of work I agree, but, nevertheless, essential.

(*To be continued*)

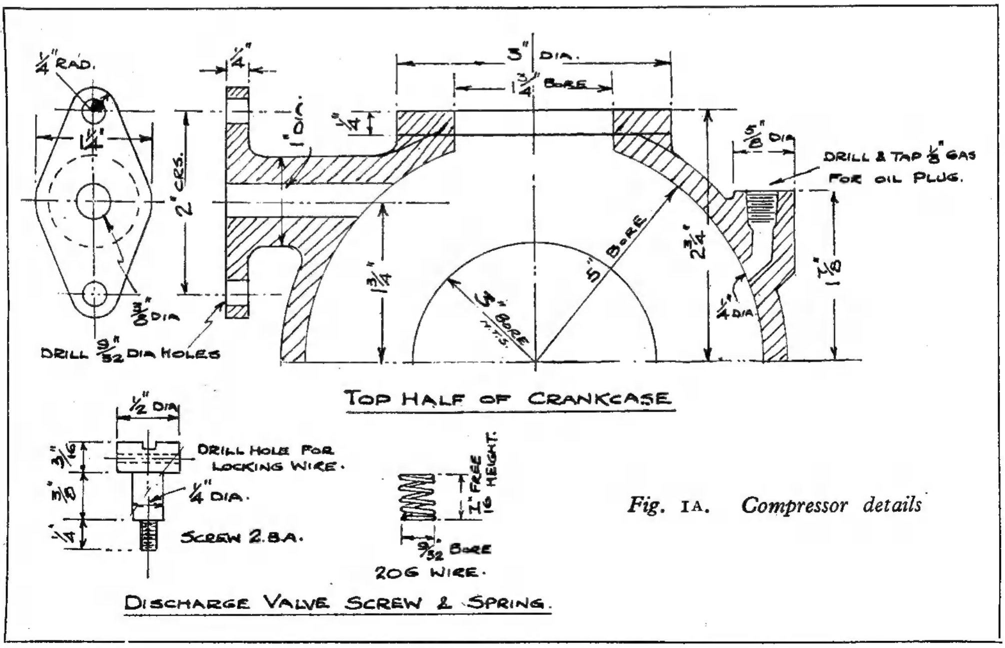


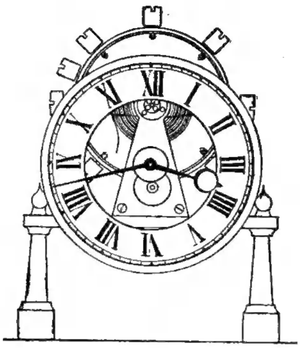
Fig. 1A. *Compressor details*

*An Electric Clock

with a Semi-free Balance

by Stanley J. Wise, F.B.H.I.

"CHECKERBOARDING" is another method which looks well if nicely done, but is rather difficult to accomplish. Whatever finish is adopted the effect will soon wear off unless some means of preserving it is applied. The usual method is, of course, by lacquering, which will now be briefly described :—



Lacquering (like many other apparently simple things, requires a rather high degree of skill to perform, if good results are expected. Two important points in this connection, are, a good lacquer, and a suitable brush, the latter being very difficult to obtain these days. The brush must be of the flat variety of good quality, without raggedness, however small, at the tip. In the old days when lacquering was a separate trade, craftsmen would spend endless time in "mellowing" their brushes ; it was only by this means that those beautiful effects were given to large telescopes and other early scientific instruments. To get the brush into anything like a suitable condition for good work, especially if "deep gold" lacquer is used, the procedure is to draw the hairs gently through finger and thumb, while saturated with lacquer, thus forming a fine chisel edge at the tip. The lacquer now retained by the brush is allowed to dry, after which the chisel edge is touched up on a fine, flat carborundum stone. It may be that a few straggling hairs are left "proud," if so, true up dead square with a razor-blade, with brush on a dead flat surface. Again stone up after this. When required for use, the brush must be cleaned by softening in methylated spirit.

Use pale gold lacquer, as this is much easier to apply than "deep gold."

The essential points to bear in mind are :—

(1) To wipe off all surplus lacquer from both sides of the brush before applying it to the job. This is best accomplished on a fairly tight wire, stretched across the top of lacquer jar.

(2) To warm the job, which will at first "cloud" over, until all "clouding" has disappeared, and *no more*.

(3) To apply the brush in straight slow strokes, from end to end evenly, and again slightly warm, after first coat is completed.

(4) Apply the strokes in an opposite sense, by reversing the plate until a second coat is completed.

(5) Repeat the process, reversing as above, until the required "tone" is obtained.

There is just one other point to note, namely, a "grained" surface, especially if "snailed," takes the lacquer much easier than a dead polished one, so be very careful in applying it to the edges.

Touch very lightly here.

Blueing Screws

There are two methods of blueing screw heads, namely by blueing-strip and silver sand. In either case the article to be blued, must first be polished. With screw heads the following method has proved quite successful :—

(*a*) Chuck screw in lathe, and polish face and edge, finishing with burnisher.

(*b*) Procure a short length of brass plate, drilling a sufficient number of holes to take the shanks of all screws being treated.

(*c*) Place in a preheated oven, or other confined space, until all screw heads reach a uniform deep blue. Move the tray about during this process to evenly distribute the heat, carefully watching the colour in the meantime. Withdraw and eject screws immediately the required colour has been reached, otherwise the effect will be ruined.

The second method consists of immersing the items in "silver sand," the whole being contained in a rather shallow metal box, or tray, which is then heated in an oven similar to that described above. Immediately the sand becomes hot enough to start colouring the items, the sand is "agitated," by lightly shaking the box to evenly distribute the heat, until a deep blue is obtained, at which instant the items are quickly ejected on to a cool surface.

There is just one more point. Don't mix large items with small screws, etc., and expect all to attain the same colour ; blue all similar items together, and keep the larger parts for individual treatment.

Assembly, Sequence No. 1

Since the finalised position of all minor components are centred round the balance, this latter sub-assembly is obviously the first job to "tackle." It is recommended that the drawings of balance and its associated components, such as the electro-magnet, contact disc, etc., should be again used for reference. Hold, as far as possible, each nicely finished part in tissue-paper during assembly ; any finger-marks must not, under any circumstances, be left. These

*Continued from page 680, "M.E.," November 24, 1949.

can be removed with a fine polishing cloth, after each component has been assembled. Try to adopt the method as used by manufacturers during assembling of a fine watch or chronometer, when no individual part is touched by hand.

Of course, there are one or two items, such as the fit of balance coil assembly on its staff, also contact disc and baseplate, which cannot be dealt with other than by handling, but once these parts are ready for finalising their position, make sure to remove every trace of finger-marks, dust, etc.

Having satisfied yourself regarding the above, proceed to assemble as follows :—

(1) Screw into their respective holes (not too tightly), the eight poise and two timing screws, round circumference of balance.

(2) Slightly ease out the centre-hole of balance electro-magnet so that it fits tightly when abutting the brass balance collet.

(3) Set coil assembly at exactly right angles to the balance arm, and slide on contact disc. This latter item must abut the electro-magnet, with contact pin facing outwards. Secure temporarily by the two 10-B.A. set-screws.

(4) Straighten up the lead in wire from coil and secure it to back of contact pin by a tiny "blob" of solder, after inserting the bare end into its hole. Leave sufficient free length to allow of a certain amount of twisting later when setting the contact position.

(5) Blow out all dust, etc., with an air blast—a pair of bellows, or cycle pump forms a good compromise.

(6) Attach each complete bearing housing to front and back pedestals, inserting four $\frac{1}{8}$-in. balls in each, before fitting glass endplates and covers. Secure each with three 12-B.A. blued screws.

(7) Attach temporarily, the front bearing pedestal to baseplate, with two 4-B.A. cheese-headed screws and lock tightly.

(8) Insert the appropriate pivot of balance (that on shortest end of staff) into its bearing, guiding it between the balls. Carefully support the opposite end in the meantime.

(9) In a similar manner, slide into position the back bearing, the balance being now supported on the balls.

(10) While in this position (the weight of balance will retain it), carefully square the edge of balance rim, with that of the plate, by slight movements of pedestal.

(11) Having finalised the position, mark through the pedestal anchorage holes with a scriber, for screw positions.

(12) Remove bearing pedestal and balance. Drill and tap the two holes 4 B.A. ; replace both balance and pedestal, finally securing it with two blued screws. The balance must now be accurately poised while in its bearings. (See page 691, Poising the Balance.)

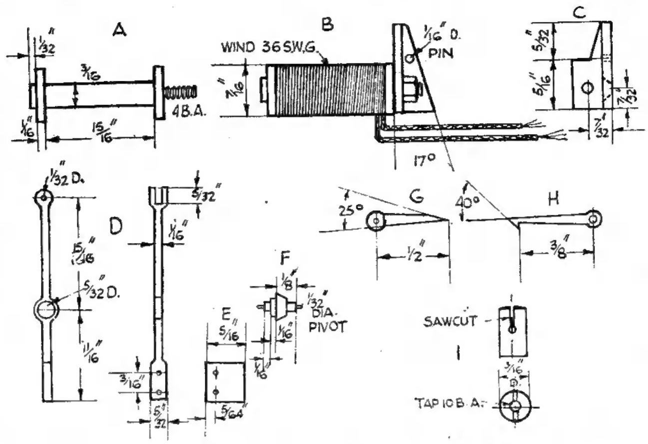


Fig. 23. Electro-magnet and other items of dial mechanism

(13) Insert the fixed coil assembly from the underside of baseplate and "monkey" it slightly until its curved pole-piece is coincident with that of the balance coil. There should be about 0.005 in. between the pole-pieces when the lower coil is abutting the bottom plate. Some "juggling" may be necessary to attain this, such as reducing slightly the bracket, or possibly packing up with shims.

(14) When finalised, mark position of bracket-holes and drill and tap them 4 B.A., after removing coil, balance and pedestals.

(15) Finish up the baseplate medium grain for surfaces, and burnish to mirror finish the edges, "snail" the upper surface and lacquer pale gold.

(16) Finish and lacquer all other parts, except, front bearing and balance assembly, although it may be advisable to lacquer contact disc, thus retaining its pleasing bright lustre.

(17) Fit control spring to balance staff, clamping it by the 10-B.A. collet screw.

Before finally assembling, the impulse dial mechanism must be finished off, as there are several more holes to drill in front pedestal, and a few more parts to make.

Fig. 23, indicates the electro-magnet and other additional components required to complete this part of the mechanism ; there is one feature in this construction, however, that should be noted, namely, the comparative lightness of the mechanism, which obviously must require very little power to operate. By reason of this, the winding and dimensions of electro-magnet are small, indeed, this is also made necessary by the limited area available on the plates. Essential parts required to complete are :—

(*a*) Electro-magnet core ; turned from good quality soft iron to measurements as shown. End discs turned up, after forcing on.

(*b*) Wind fully, with No. 36 s.w.g. enamelled wire, d.c. resistance, not less than 20 ohms. Bring both starting and finishing ends out, at one side as shown.

(*c*) Attachment lug. Cut out from $\frac{1}{16}$ in.

angle brass to measurements. Drill one countersunk 4-B.A. hole for base attachment, plus a plain 4-B.A. clearance hole to take electro-magnet shank, also drill a $\frac{1}{16}$-in. steady pin-hole, as shown.

(*d*) Rocker arm. File to shape as shown, keeping everything as light as possible. Drill and ream the centre hole to measurements. The attachment holes, seen at bottom, can be 12 B.A. clearance. Straight grain sides, and burnish edges.

(*e*) Shape to measurements from $\frac{1}{8}$ in. good soft iron. Drill and tap the two attachment holes 12 B.A.

(*f*) Rocker arm staff. Turn from silver-steel, carefully to measurements. The spigot portion *must* be a tight fit into its hole on rocker arm. The actual diameter of arbor, and seating boss are unimportant, provided enough material is left to form a bearing surface for rocker arm, etc.

(*g*) Propulsion pawl. Shape from silver-steel to the pitch indicated, keeping the nose angle as accurate as possible. Reduce the thickness at the axis sufficiently to allow perfectly free movement when inserted between the jaws of rocker arm (*d*).

(*h*) Retention pawl. Shape from silver-steel, keeping nose angle correct as possible. The pitch must also be exact.

(*i*) Nose stop pillar. Turn from $\frac{3}{16}$-in. brass rod. Drill and tap a 10-B.A. screw-hole as shown, finally slitting with fine saw. Polish and lacquer.

The remaining holes should now be drilled in pedestal face, as indicated in Fig. 14. These are as follows :—

(*a*) An 8-B.A. clearance hole, accommodating anchorage screw for nose stop pillar (upper left).

(*b*) Electro-magnet, 6-B.A. anchorage screw (lower right).

(*c*) Rocker arm return spring, tapped 10 B.A. (lower left).

(*d*) Two 3/64-in. plain holes to accommodate rocker arm stop-pins. The pedestal can now be finished and lacquered, as in Fig. 13.

Assemble now as follows :—

(1) Attach electro-magnet anchorage lug with one 6-B.A. countersunk-headed screw, not too tightly. Slide coil into position and secure to base by 4-B.A. hex. nut. Do not lock too tightly.

(2) Move coil up, or down, as the case may be, until it is exactly parallel with the base line, after which, drill the $\frac{1}{16}$-in. steady pin hole, using that already formed on lug, as a template. Remove coil.

(3) File, slightly taper an oversize brass pin and tightly insert in hole extending through both lug and about two-thirds of face, cut off the pin as close as possible, and finally file down to outer surface. Finish to medium grain.

(4) Tightly insert the two rocker arm stop-pins as shown.

(5) Reassemble electro-magnet to base as above (sub-para. 1), but lock all screws tightly.

(6) Attach rocker arm return spring with two 10-B.A. shallow-headed screws. For sake of clearness this is not shown on Fig. 14. See Fig. 24.

(7) Fit staff to rocker arm, slightly "burring" over the spigot face to secure.

(8) Attach propulsion pawl in fork of rocker arm with a highly polished 1/32 in. diameter axis pin, slightly taper. Note the pawl must be absolutely free to fall by its own weight.

(9) Assemble the backstop, or retention pawl, by one 12-B.A. shouldered screw. This pawl must also be absolutely free.

(10) Attach the iron armature to lower end of rocker arm, by two 12-B.A. shallow-headed screws. These must not extend completely through.

The remainder of assembly will be clear on examining Fig. 24. Place all three gears and rocker arm into position, with their pivots correctly located, making sure that both pawls are approximately engaged with teeth of ratchet wheel. Place the top plate carefully into position, and guide the various pivots into their respective front plate holes. Secure with three 10-B.A. nicely blued screws, with rather large heads.

It only now remains to correctly adjust the mechanism to obtain positive results with a minimum of battery e.m.f. The first thing necessary then is to adjust, by slightly bending the rocker arm stop, so that the armature becomes arrested a fraction before (about 0.005 in.) abutting the electro-magnet core. At the same time, carefully check the movement of propulsion pawl, which should have just dropped into one ratchet tooth and no more. It may be found necessary slightly to bend rocker arm to obtain this. Upon now gently releasing the arm note if one tooth is carried sufficiently far forward to be retained by backstop, if not, it must be nearly so, and can be corrected by slight bending of the outer, or opposite arresting stop.

Connect a $1\frac{1}{2}$-V. battery to one end of the coil, slowly make and break the circuit with the remaining wire and check that everything works quite freely ; if so, adjust propulsion pawl nose screw, so that it arrests the nose, but does not prevent full progression of the tooth on $1\frac{1}{2}$ V., but prevents overshooting of teeth when the voltage is increased to 3 V. or two cells. Oil all pivots, except those of the pawls, with good quality watch oil. Use very sparingly, the smallest possible amount on each point is sufficient.

Assembly, Sequence No. 2

The main assembly can now be continued from sequence No. 1, as follows :—

(*a*) Assemble front bearing pedestal and dial assembly to baseplate, and secure by two finished 4-B.A. cheese-headed screws, lock tightly. Also fit control spring anchorage-stud, but do not tighten clamping screw.

(*b*) Fit the two supporting columns to baseplate, secure by screwing on the two finals, locking these fairly tight. The whole should now be mounted on a temporary wood base.

(*c*) Holding the complete balance assembly in the right hand, carefully insert the front pivot between the balls of its appropriate bearing. Now, with the left hand, slide back bearing pedestal into position with pivot riding the balls as above, and secure.

(*d*) Place contact switch supporting column,

into its slot on baseplate, and lock temporarily with a well finished 2-B.A. hex.-nut, from underside.

(*e*) Proceed to fit together contact lever sub-assembly in the following order: Lightly insert into its $\frac{1}{8}$-in. hole on mounting plate (1), Fig. 12, the fibre plug (6). Push flanged fibre bush (4) into the $\frac{3}{16}$-in. bearing hole, and insert lever axis pivot (3). Place insulated washer (5) on underside of bush (3), and secure the whole with

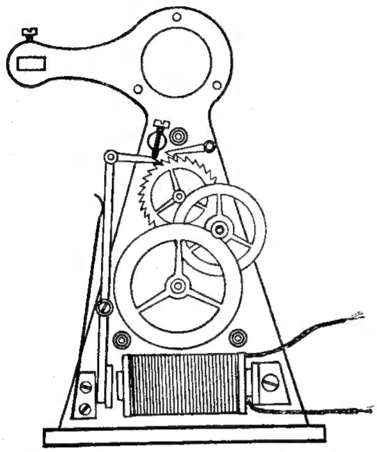


Fig. 24. Layout of impulse dial mechanism when assembled

an 8-B.A. hex.-nut and light brass washer. Prepare a brass pin (slightly taper) of sufficient thickness to fit tightly into the $\frac{1}{16}$-in. centre hole of plug (6). Cut off, leaving a projection of about $\frac{3}{16}$ in. on front face and approximately $\frac{1}{8}$ in. on back. Slightly round the ends, and burnish; also file two shallow "flats" on front extension, parallel with the plate. At a distance of 5/32 in. from plug shoulder, drill a 1/64-in. hole to take end of hairspring; this should now be "broached" until the largest diameter of its taper is just under 1/32 in. Carefully place lever assembly on pivot, and guide end of hairspring through hole in stud, securing it with a small taper pin previously prepared. Contact lever should assume a position parallel to mounting plate. It may be necessary to unpin the spring to obtain this.

It only remains to fit the retaining cock (2), Fig. 12, securing it with an 8-B.A. steel screw. Interpose a small slip of thin insulating material between outer pivot extension and retaining cock before finally locking the screw, as this point must be insulated.

(*f*) Assemble contact lever sub-assembly to upper end of supporting column by one 4-B.A. cheese-headed screw. See that nose of lever points a little above the balance axis, but this will be adjusted later.

Poising the Balance

Poising is an art that can only be acquired by experience; more especially is this so when small watch balances are being dealt with. If, however, the following instructions are carefully carried out, there is no reason why results approaching absolute accuracy should not be obtained. Fortunately, a heavy balance of this type, especially when oscillating at constant arc in one plane only, does not require the same accuracy in poise as, say, a watch, wherever the plane of balance is being continually changed. Before starting to poise, the following 4-B.A. brass washers will be required: 8, 1/32 in. thick; 8, 1/64 in. thick; 16, 0.001 in. thick.

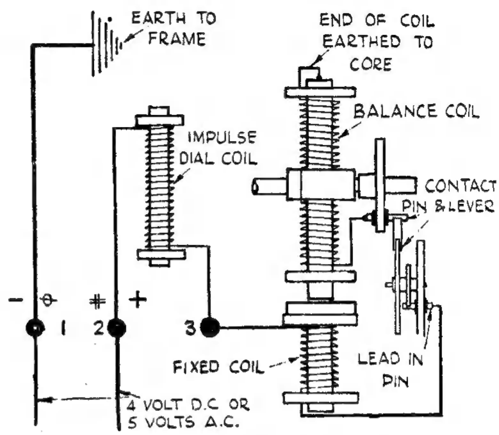


Fig. 25. Wiring diagram

These are large watch hour wheel dial washers, and can be procured at any material dealers quite cheaply.

With balance supported on its bearings (which are very sensitive indeed), remove all rim screws except the two timing and two diametrically opposite poise screws at right angles to balance arm. Now proceed as follows:—

Rotate balance until the electro-magnet is *exactly* horizontal, noting the result; if now, the lower end of coil is displaced downwards, which will probably be the case, add one or more washers under the screw immediately opposite. These former items can be either fairly thick, thin or a combination of both, anyway, sufficient additional weight must be added until the coil will remain absolutely horizontal, even when bearing friction is overcome by light "tapping." To attain final refinement of balance, it may be necessary to interpose one or more "foil" washers in combination.

Now rotate the balance through 90 deg. with coil pointing downwards, and again note results. Should one arm tend to be displaced, add a washer, or washers under the head of that timing screw diametrically opposite, until balance remains stationary, when friction is overcome by light tapping of pedestal. If the balance rim is dead true, it should now be possible for it to remain stationary in any position through 360 deg.

In a similar manner to that described, proceed to balance up each pair of all the remaining screws, but since these have been individually weighed, the out-of-balance magnitude will be small, if

any. This then, is where the 0.001 in. foil washers come in. There is one point here that needs emphasising, namely: any displacement now of the coil in relation to balance arm, will destroy all resemblance of correct poise.

Wiring of Clock and Impulse Dial

The wiring circuit is very simple, and should be carried out [redacted] neatly [redacted] possible using the finest flex obtainable. This pattern contains [redacted] 1 mm. sheathing, and can be obtained in various colours, choose blue for all in-circuits and black for return. Run the wires out of sight [redacted] far [redacted] possible. To further facilitate neatness, make up [redacted] three-terminal junction block, and screw it to the base.

Keeping Fig. 25 in front of you, start to wire [redacted] follows :—

(*a*) Black.—From terminal No. 1 to frame of clock ; anchor under any suitable screw.

(*b*) Blue.—From terminal No. 2 to one end of impulse dial coil.

(*c*) Blue.—From remaining end of impulse dial coil to terminal No. 3.

(*d*) Blue.—From No. 3 terminal to outer end of fixed balance coil.

(*e*) Blue.—From remaining end of balance fixed coil, to contact switch lead in pin.

The remaining end contact pin to outer end of balance coil has already been made, during preliminary assembly. The connection mentioned in sub-para. (*e*) must be made with a minimum of solder, using dissolved resin as [redacted] flux.

Before any electrical adjustment can be attempted, the periodicity of the balance should be brought approximately to time in the following manner :—

(*a*) Clamp the outer end of balance control spring into its stud, interposing a thin steel wedge between shank of screw and spring. Do not clamp too tightly.

(*b*) Give balance an initial swing, and time the resultant oscillations with [redacted] stopwatch over one minute. The vibrations should equal 60 per min., but will probably be less.

(*c*) Take the spring up until the nearest approximation to time is attained, and lock the control spring in stud temporarily.

(*d*) Slacken collet clamping screw, and reset position of balance so that the pole-piece of balance coil is just entering the curved track of fixed electro-magnet. Lock control spring in this position.

Note.—The vibrations of balance will persist for at least 5 min., but do not time after the first 60 sec.

It now remains to obtain correct electrical adjustment and here are [redacted] few "tips" that will help. The great thing is the refinement necessary in arranging the contact period in such [redacted] way [redacted] to enable the balance to perform [redacted] maximum arc with [redacted] minimum of current expenditure. At the same time the period must be sufficiently prolonged to allow impulse-dial electro-magnet to reach workable magnetising characteristics.

There is just one other important point, namely, by arranging the contact period to break the circuit after the zero line, but [redacted] mere fraction before the pole-pieces have separated, it is possible to obtain [redacted] positive, compensating effect covering slight variations in voltage. The following adjustments should now be made :—

(1) Rotate contact disc until the pin just touches conduction side of lever, when the pole of balance electro-magnet is about to enter its neighbouring pole "track" on fixed coil. Lock temporarily in this position.

(2) Rotate balance until contact pin just breaks the circuit, again noting relative position of pole-pieces, which should be just about to separate on trailing edges.

Should the above conditions not be fulfilled, then the contact period is either too long, or too short, and can be remedied by :—

(*a*) If too long, slacken the 4-B.A. clamping nut and move contact supporting column slightly outwards, thus decreasing engagement between pin and run of switch.

(*b*) If too short, adjust [redacted] above, but in [redacted] opposite sense, thus lengthening the engagement period. Final adjustment, however, can only be obtained under actual working conditions.

Connect [redacted] 4½-V cell to the appropriate leads, and start the balance oscillating. It should reach 75 per cent. of [redacted] revolution each side of zero, *but no more, or no less.* If more, again slightly decrease the contact period [redacted] above and vice versa. Now watch the impulse dial at each *complete* vibration of balance, i.e., every two seconds. If impulses are unduly weak, move contact assembly slightly upwards by slackening the 4-B.A. clamping screw. This will increase the period a small amount by "offsetting" the striking position to a point where the balance has not reached its maximum velocity.

Should however, the dial be too fierce in action it must be shunted by about 15 ohms, or [redacted] few turns of 30 s.w.g. eureka wire, which should be adjusted until positive, but not violent results are obtained.

A careful combination of all these adjustments will attain good working results which should remain stable for years. All refinements of further timing must be carried out by adding or removing washers from the timing screws, but it should be remembered that under no circumstances must the original washers (used for poising at this point) be interfered with.

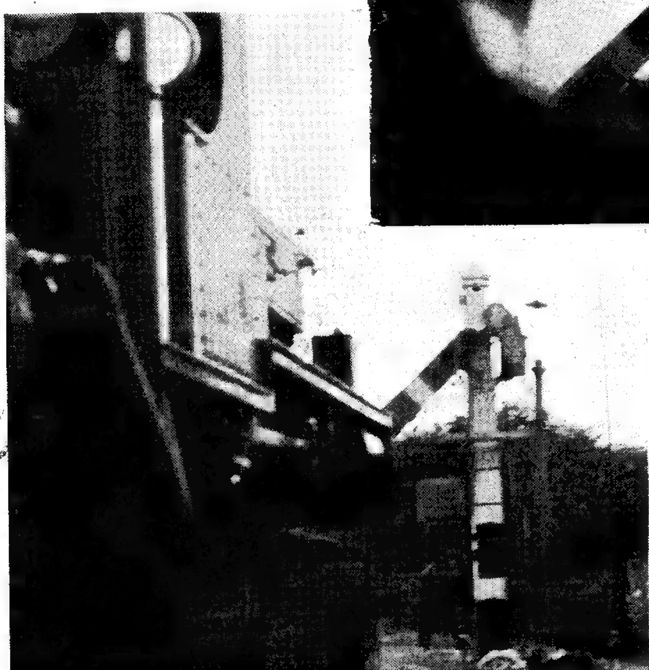
There is still the dial, hands and base and case. The former should be purchased from [redacted] material dealers, also the hands. Regarding the base and case, make the former deep enough to accommodate the batteries or transformer. The case which would look very handsome, would be of rectangular type with bevelled glass panels on all faces, but failing this [redacted] ordinary circular glass dome could be used.

I mentioned in the introduction the fact of using [redacted] plain steel balance in place of the compensated form. In actual fact, better isochronism between the balance and control spring can be obtained by the use of such a balance, provided a Phillips overcoil spring is used. This overcoil must, however, be correctly formed, to conform to [redacted] true theoretical terminal curve.

The spring in its ordinary form can be supplied by Mr. H. J. Phipps, 33a, High Street, Ruislip, Middlesex.—Quote [redacted] blue finish.

When North came South

by "L.B.S.C."



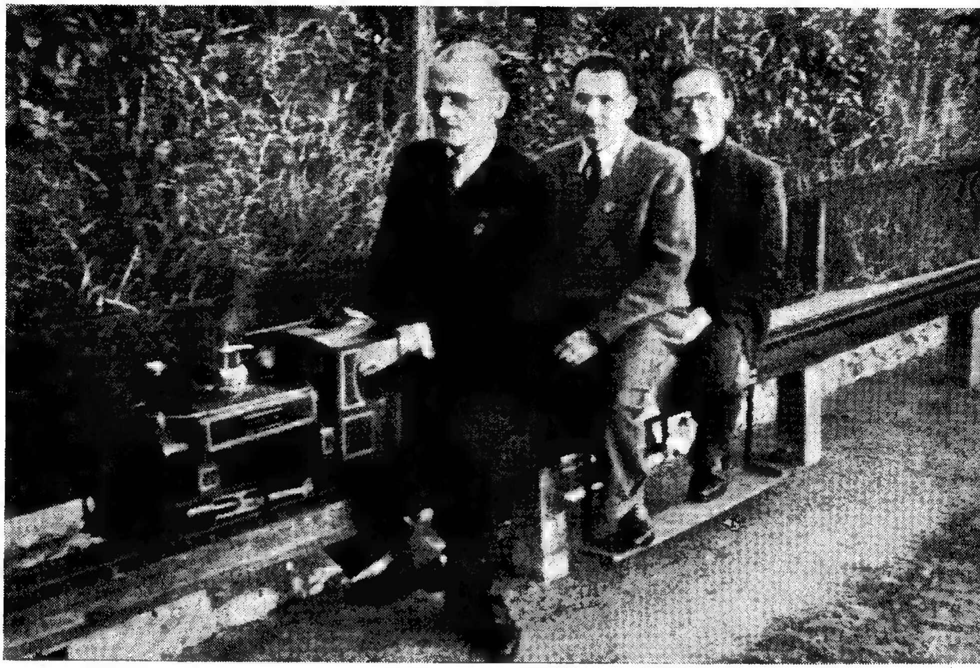
Above—What "Susie M's" driver sees

Left—A bit of realism

A BATCH of photographs has just come to hand from Mr. A. J. Bradley, Editor of the North London S.M.E. "News Sheet," is a happy reminder of the Saturday, when he, in company with Messrs. Moon, Drayson, and the engine "Susie M" visited my workshop and railway. Two of these pictures are by way of being unique, and I thought maybe they would interest followers of these notes, so here they are. I have seen a good many pictures taken through the cab windows of full-sized engines, but at the moment I don't remember seeing a print of a shot through the cab window of a little engine. Anyway, the one taken through "Susie M's" cab window is a proper "have"; nobody would ever dream that the engine was only 3½-in. gauge. The little bit of "Susie's" chimney that can be seen, is indistinguishable from full size; the signal actually *is* full size, whilst the lamp standard behind the signal, might well be at the entrance of a full-sized country goods depot. They say "photographs cannot lie"—but they can be mighty deceiving! The view taken at the side also gives a good "full-size" impression; it only needs a driver or fireman looking over the side, to finish it off.

The other photograph not only shows the concentration of load that finally finished off the rotted section of longitudinals on my railway, but it also shows part of the retaining wall along the east side straight section, and the tarmac path, a combination now enabling cars with footboards to be used. Before the wall was built, earth and stones from the bank were continually falling down and blocking the space between the bank and the railway. Also, unless the grass received constant attention from the garden shears, it grew up all around the posts, and was soon projecting up between the sleepers, same as shown in the

section of the high-level straight line just above "Susie's" chimney. I cured this by giving the whole length of the ground under the high-level a good dose of weed-killer; as this was done during the hot spell at the end of the summer, the withered grass and weeds rapidly became as dry and inflammable as tinder. Then a live cinder from "Ayesha's" chimney set the lot alight, and in a few minutes my grass-and-weeds troubles were settled for the rest of the year. Another little bit of inadvertent realism—a "scale" bank fire started by a little engine!



The load that found the weak spot!

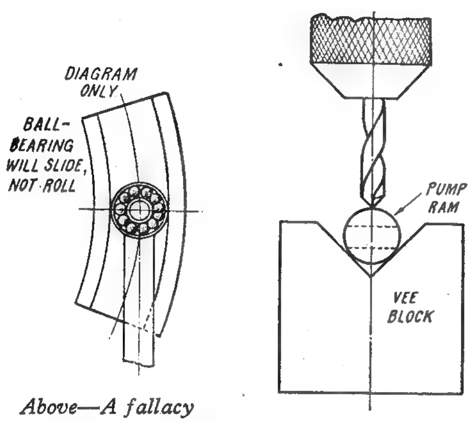
Missing the Obvious

A reader who is building the 5-in. gauge "Minx" and using Joy valve-gear, has got hold of what he thinks is a bright idea. He says that in a "full-size" journal, he saw a drawing of a radial valve gear which derived part of its movement from an inclined curved slide-shaft, similar to that of a Joy gear; but the dieblocks weren't dieblocks at all (says Pat). They were ball-bearings, mounted one on each end of the pin going through the oscillating link, or vibrating link as it is called in Joy gear. It was claimed that rubbing friction in the radial gear was entirely done away with, as the ball-races would roll up and down the curved guides, in place of the friction of two sliding blocks. Our friend says he has some weeny ball-bearings, as used in aero instrument work, and suggests making his Joy slides wide enough to take these bearings, mounting them on the pins in place of the dieblocks which I specified, and eliminating wear and friction.

Well, I'm sorry to disappoint him, but it just won't work out that way; and in case other readers saw the description of the ball-bearing radial gear mentioned by our friend and got hold of the same idea, I thought it might save unnecessary labour and disillusionment if I called attention to the matter here. I read the account referred to, and spotted the wasp in the jam pot right away, as I expect many others did. The error was obvious, and it puzzled me as to how the writer of the article came to overlook it.

If you mount a wheel on a spindle, and turn the wheel, the top part of the wheel moves one way, and the bottom part of the wheel goes the other way. Likewise, whilst one side goes up, the other side goes down. Elementary, my dear Watson, as Sherlock Holmes would have remarked; yet in putting his ball-bearings between two fixed surfaces, *and expecting them to roll on both surfaces at once, in the same direction*, the designer of the radial gear completely overlooked that simple fact. Take a look at the illustration, and you will grasp in a minute, that if either side rolls on the surface of the guide, the other side of necessity must move in the opposite direction, thus slipping badly on the guide on that side, causing more friction than a sliding dieblock. What would actually happen—I tried it with a temporary rig-up—is that the ball-bearing *slides* up and down; the outer race slides in the guides, and the inner race and the balls move just to the extent of the oscillation of the vibrating link. It would have been better if the designer of the "frictionless" gear had used ordinary dieblocks to slide between his

guides, and let into them [redacted] pair of small ball-bearings to accommodate the ends of the pins in the oscillating lever. Ball-bearings running directly in the guides, would only have a line contact at each side, and they would rapidly wear, throwing the whole gear out of accurate setting. In the case of the Joy gear for the "Minx," the wear between dieblock and pin is negligible, and it will be [redacted] considerable time before any wear develops between dieblock and guides, owing to the amount of rubbing surface



Above—A fallacy
Right—How to drill pump ram

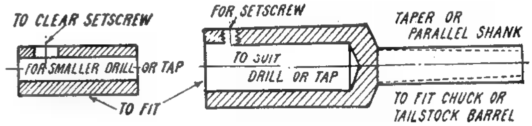
specified; so there is no need for ball-bearings in the gear at all. Unofficial history records that ball-bearings which could roll on two opposed surfaces at the same time, were used in the famous American locomotive of Casey Jones days, which was designed to go both ways at once!

Beginners' Corner (contd.) Pump for "Tich"

We left off with the body machined and valves fitted, so now we need a gland and ram. The gland may be made from a hexagon-shaped casting, or from [redacted] piece of hexagon bronze or gunmetal rod measuring $\frac{5}{8}$ in. across the flats. This can be sawn or parted off from a longer piece of bar; if sawn, allow enough for facing both ends, to bring the finished length to $\frac{1}{2}$ in. The machining of either casting, or piece of rod, is exactly the same. Chuck in three-jaw; it doesn't matter if the chuck is slightly out of truth in this case, as all the machining is done at the [redacted] setting. Face the end, centre, and drill [redacted] $\frac{1}{8}$-in. or No. 30 pilot hole right through. Open out with a 19/64-in. or letter N drill, letting it go right through. Further open out to $\frac{3}{8}$ in. depth with [redacted] 29/64-in. drill, and tap $\frac{1}{2}$ in. by 26 or 32, to suit the thread [redacted] the pump barrel. Note, the gland should not be too easy [redacted] fit on the pump barrel, otherwise it will try to slack back when the engine is working; and if it does, it will release the packing, and allow water to escape at the gland instead of being forced into the boiler. No gland of any sort should be too easy on the threads. Several [redacted] have occurred, where piston glands have worked out, and [redacted] the return stroke, have been caught between crosshead and stuffing-box, causing considerable damage to the engine.

It may possibly happen that some beginners have [redacted] tailstock chuck that won't take a $\frac{1}{2}$-in. drill or tap. This will call for [redacted] bit of judicious wangling. Most of the larger sizes of drills and taps have [redacted] centre-hole in the end. In that case, put the centre point in the tailstock, and clamp [redacted] carrier on the shank of the drill or tap. Put a tool crosswise in the slide-rest with the shank end projecting, or use [redacted] piece of bar. Let the tail of the carrier rest on it, to prevent the drill or tap turning; run up the centre so that it engages with the hole in the end of the drill or tap, and holds [redacted] truly; then go ahead as if using [redacted] tailstock chuck.

If the drills and taps haven't any centre-holes in the end, and are too hard to be held in three-jaw and centred with [redacted] ordinary centre-drill of the Slocomb type, the only thing to do, is to make sockets. They are easy enough to make. A piece of round rod is required; any metal, even soft brass will do. First centre both ends; then with the piece mounted between lathe centres, either turn the outer end taper, to fit the taper in the tailstock barrel, or turn it parallel, to the biggest size your tailstock chuck will accommodate. Then put it either in tailstock barrel or chuck, as the case may be. Put a drill in the three-jaw, run up the tailstock with the socket blank in it, and drill a hole in the end, [redacted] shown in the illustration; the size of the hole, of course, should be to accommodate the size of drill or tap you want to use in the socket. A set-screw can be fitted, for holding drills. For different sized shanks, all you need is a set of sleeves, home-made in a few minutes. If, for example, you make the "master" socket $\frac{1}{2}$-in. bore, you can use bits of $\frac{1}{2}$-in. rod in it, each [redacted] drilled out for [redacted] smaller size of drill. A hole can be made in each, for the set-screw to pass, and get to the drill. This is how the old craftsmen managed in the days before three jaws, tailstock



Home-made drill socket

chucks, and other modern conveniences came into general use.

Returning to our gland, chamfer the corners of the hexagon and put a $\frac{5}{16}$-in. parallel reamer through the small hole; then reverse it in the chuck, face off the other end, and chamfer also Whilst you have the drills and tap handy, make the lock-nut. This is either [redacted] casting, or [redacted] piece of hexagon rod, [redacted] as the gland, but only [redacted] full $\frac{3}{16}$ in. long. Chuck in three-jaw; face, centre, drill [redacted] small pilot hole right through, then open out and tap exactly the same as the gland, putting the 29/64-in. drill, and the $\frac{1}{2}$-in. tap clean through. Reverse in chuck, setting to run truly, and take [redacted] cleaning-up skim off the other side.

Pump Ram

If a piece of $\frac{5}{16}$-in. ground rustless steel, or phosphor-bronze rod is available, very little machining will be needed on the pump ram. If you haven't a bit this size, chuck a piece the nearest size larger, and turn $1\frac{3}{8}$ in. length to $\frac{5}{16}$ in. diameter, using the gland as a gauge, and turning to an exact sliding fit. You'll find that easier than turning wheel seats! Part off at $1\frac{11}{16}$ in. from the end. The ground rustless, or drawn bronze, if either is used, should be the same length. Now reverse in chuck, turn $\frac{1}{4}$ in. length to $\frac{1}{8}$ in. diameter, and bevel off the shoulder as shown in the recently-published illustration, to match the drilled end of the pump barrel. This pin, which I call the anti-airlock pin, is to prevent air being trapped in the pump barrel, and causing the pump either to deliver short measure, or fail altogether. Eccentric-driven pumps, in the past, were stated to be "not altogether satisfactory." It wasn't any fault of the pumps, but the designs, which allowed air pockets. Air is, as everybody knows, freely compressible, while water isn't. If you have an air space in the pump barrel, air will be compressed into it, up to boiler pressure, on the inward stroke of the pump ram. On the outward stroke, the air simply expands again, fills the pump barrel, or partly fills it, as the case may be, according to the clearance between the ram and the end of the barrel. As no water will get past the inlet valve whilst the pressure on it exceeds that of the atmosphere, it is easy to see why the pump is a partial or complete failure. In this pump, the pin left on the end of the ram, goes through the small hole at the end of the barrel, right into the valve box; and even when the pump is set to work for the first time, with a barrel full of air, the first inward stroke of the ram expels it all past the delivery valve, the close clearances, and the pin, ensuring that there wouldn't be enough air left in the pump barrel, on front dead centre, to supply the lungs of a gnat for a couple of minutes. The instant that the ram starts its outward stroke, a partial vacuum is created in the pump barrel, sucking in a charge of water via the inlet or suction valve. Beginners should now be able to see why the pump will always "fill the pot," as old enginemen used to say before injectors came into general use.

At $1\frac{3}{16}$ in. from the shoulder, drill a 7/64-in. hole through the pump ram. The best way to do this is to make a heavy centre dot at the location of the hole, and drill the hole with the ram resting in a vee-block, either on the drilling-machine table, or held against a drilling pad on the lathe tailstock barrel. I have already explained how a serviceable vee-block can be made with two pieces of sheet metal held parallel, $\frac{1}{2}$ in. or so apart, by spacers; but a pair of regular mechanics' vee-blocks are not very expensive, and are exceedingly useful. After drilling, chuck the ram in the three-jaw again, and round off the drilled end.

The next job is to slot the end of the ram for the eccentric rod. The easiest way is to clamp it under the lathe tool-holder, and run it up to a $\frac{1}{8}$-in. saw-type slotting cutter, mounted on a spindle held in the three-jaw, or between centres. Use plenty of cutting oil, feed very slowly, and run the lathe at a slow speed. The slot can also be cut by hand, using a couple of hacksaw blades in the frame, side by side, to make a fairly wide rough slot to start with. This is then trued up, and finished to size, by aid of a thin flat file, as used for cutting wards in keys. Use a piece of $\frac{1}{8}$-in. flat rod for a gauge. Now screw the gland on the pump barrel, and try the ram in it. The ram should slide freely the full length of barrel, whatever the position of the gland on the barrel.

Next, screw the pump barrel into the pump stay until it projects about $\frac{1}{2}$ in.; the valve-box caps will have to be slacked back half-a-turn, to enable this to be done. Then put on the lock-nut, and screw it up tightly against the stay, so that the pump barrel cannot become slack. Don't forget that the end with the T-piece goes at the top! The gland can then be packed with a few strands of packing, unravelled from a bit of full-size hydraulic packing, for preference. If not available, use graphited yarn, or soft hemp well tallowed. Plaited lamp wick, unravelled, and soaked in black cylinder oil, also does well.

How to Machine the Eccentric Strap

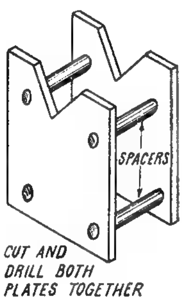
It is surprising how often beginners go to work the wrong way on a simple job, and get into a tangle. Eccentric-straps are a case in point. I know of several beginners who have cheerfully bored and faced a strap, sawn it across, screwed the two halves together, and then found that not only was the hole oval, but the two halves joined on an angle, so that the strap wouldn't fit the groove in the tumbler. The proper way is easy enough. In the present instance, centre-pop both lugs first, and drill them No. 48, clean through where the screws will go. Next, mark a line across the centre of both lugs on the casting. Put it in the bench vice with this line just showing above the jaws. With a thin fine-toothed blade mounted sideways in your hacksaw frame, saw right across both lugs, keeping the blade pressed down on the top of the vice jaws. By this means you get a fine straight cut, and the two halves of the strap will line up properly when screwed together. Give each half a rub on a smooth flat file laid on the bench, to take the roughness off the saw-cuts. Open out the holes in the upper half, with No. 41 drill; tap those in the lower half, 3/32 in. or 7-B.A., then screw the halves together with a couple of cheese-headed screws.

Now chuck the strap in the four-jaw, with the hole running as truly as possible; you won't get it perfectly true, as it is oval. Leave about $\frac{1}{16}$ in. of the strap standing clear of the chuck jaws; and with a round-nose tool set crosswise in the rest, face this off. Next, with an ordinary boring tool, carefully bore the strap until it is an easy fit, without any shake, on the eccentric. If you have an accurate slide gauge, you can set the outside jaws to the eccentric, and use the inside jaws to gauge the hole, as the jaws should register exactly when adjusted; but a lot of them don't. I've only one small slide-gauge that is absolutely accurate on both inside and outside jaws at once, and that is, sad to say, one of Jerry's productions. I have two big ones, a Swiss and an American, that are both O.K.

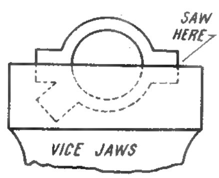
The best way for a beginner, is to chuck a stub of round steel, or any other odd bit of metal of suitable diameter, and turn $\frac{1}{4}$ in. of it to exactly

the same diameter as the eccentric at the bottom of the groove. This can not only be used to gauge the hole in the strap, boring out same until the turned piece fits exactly, but it can be used as a mandrel for finishing off the other side of the eccentric-strap. Chuck it in the three-jaw, put a thin strip of paper around the turned part, and put the eccentric-strap on it over the paper, rough side outwards, just overhanging the end of the mandrel. Secure the eccentric-strap by its own two screws; the paper will allow it to grip tightly. Then carefully face off the rough side, with a round-nose tool set crosswise in the rest, until the strap is reduced sufficiently to fit in the groove in the eccentric; the actual measurement is $\frac{3}{16}$ in. bare.

The lug for attaching the eccentric-rod can be slotted by gripping the strap in a machine-vice (regular or improvised) on the lathe saddle, and traversing under a $\frac{1}{8}$-in. slotting cutter of saw type; same one as used for slotting the pump ram. It can also be done by clamping the strap on its side under the slide-rest tool holder, and traversing across a little $\frac{1}{8}$-in. slot drill, made as previously described in earlier instalments. As a last resort, it could be formed by hand, as mentioned for the slot in the pump ram.



Improvised vee-block

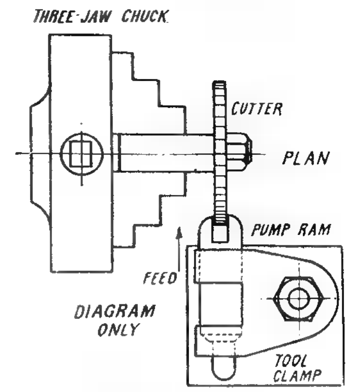


How to divide eccentric-strap casting

Eccentric-rod and Pin

The eccentric-rod is a simple filing job, made from a piece of $\frac{1}{8}$-in. mild-steel, $\frac{3}{8}$ in. wide and $1\frac{5}{8}$ in. long. The larger end is fitted into the lug in the strap, and riveted in by two $\frac{1}{16}$-in. rivets, or pieces of domestic blanket pins would do. Countersink the holes both sides of the lug, rivet the ends of the pins into both countersinks, and file flush. If the rod is soldered into the lug before putting in the rivets, it makes the job easier. Round off the small end roughly, but don't drill the hole yet.

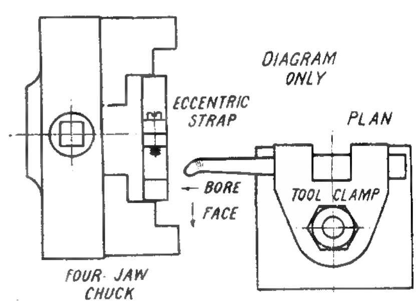
This pump needs a special gudgeon pin, or wrist pin as it is sometimes called, as the drive for the mechanical lubricator will be taken off it, obviating the use of a separate eccentric. To make it, chuck a piece of $\frac{1}{8}$-in. round steel in the three-jaw, and turn down a bare $\frac{1}{2}$ in. length to 7/64 in. diameter, a sliding fit without shake, in the cross-hole in the pump-ram. Turn down 5/32 in. of the end of this, to 3/32 in. diameter, and screw it 3/32 in. or 7 B.A. Part off at 1 in. from the end; reverse in chuck, turn down $\frac{1}{4}$ in. length to 3/32 in. diameter, and screw a bare half of this either 3/32 in. or 7 B.A.



How to slot pump ram

How to Erect and Couple-up

Replace the pump stay in the frames, with pump attached, securing by the screws already fitted. Attach the eccentric-strap to the tumbler by means of the two screws in the lugs, and see that the strap is quite free on it, able to revolve easily, without binding either on the bottom or sides of the groove. A tight eccentric strap acts as a very efficient "band brake" on the engine. Adjust the eccentric on the axle until the rod can be fitted easily into the slot in the pump-ram, without having to strain it either way. Now push the pump-ram right in as far as it will go; then put the end of the eccentric-rod in the slot, with the eccentric on front dead centre. Put the business end of a bent scriber through one of the holes in the ram, and make a little circle on the eccentric-rod, denoting position of hole. Take off the strap and rod; note the centre of the little marked circle, at the end of the rod, *and at 1/32 in. nearer to the strap*, make a centre-pop. Drill this with a 7/64-in. drill, and file the end of the rod to shape around the hole. This will give the correct clearance between the ram and the end of the barrel.



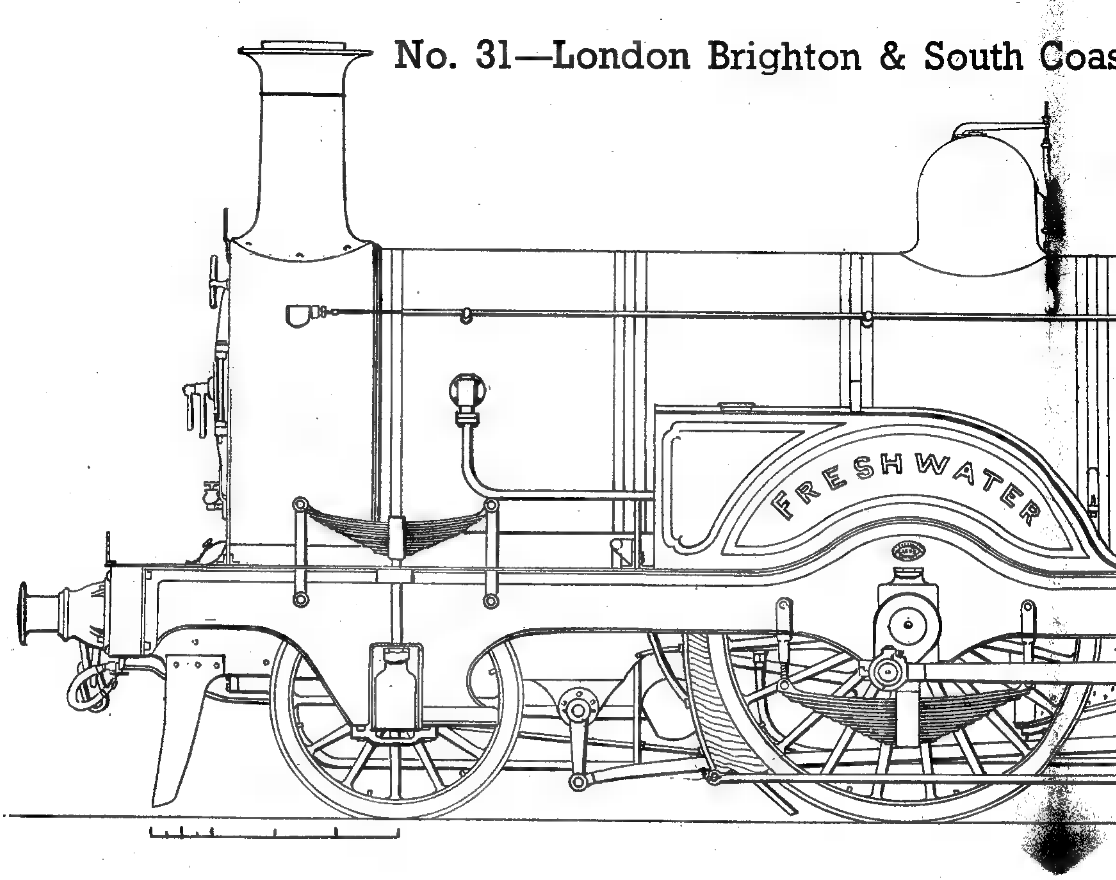
How to bore eccentric straps

To prevent undue wear, this eye may be

(*Continued on page* 700)

LOCOMOTIVES WORTH MODE

No. 31—London Brighton & South Coas



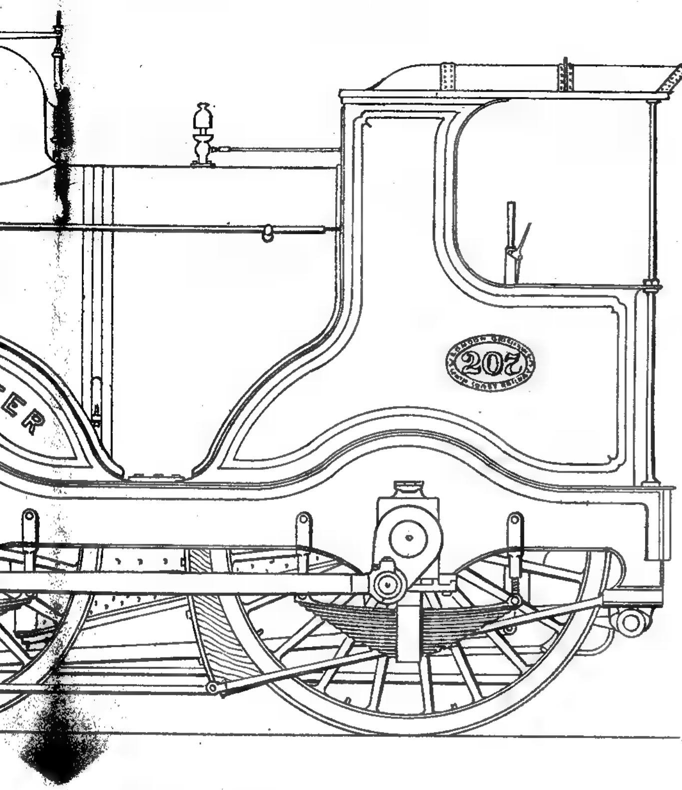
The last of the race of 2-4-0 L.B. &. S.C.R. engines was a noble-look

BEFORE I describe our London, Chatham & Dover Railway friend *Asia* in her rebuilt condition, and rejoicing in her new livery of black paint, I want to say something about a near neighbour of hers that suddenly appeared in the London area. Indeed, one might say that this newcomer almost rubbed shoulders (or should it be buffer-beams ?) with *Asia*, for both these engines passed by each other very closely as they puffed through that curious station named Grosvenor Road. Curious station it undoubtedly was, for it consisted of bare wooden platforms erected on the girders of the broad railway bridge spanning old Father Thames, a structure shared between the L.C.D. Rly. and the L.B.S.C. Rly. The bleak platforms were open to every wind that blew, and though few passengers availed themselves of such an opportunity to fill their lungs with ample doses of fresh air, the poor ticket-collectors who spent their lives trudging up and down, opening and banging doors while collecting the tickets of passengers anxious to get on and arrive at Victoria (for all up trains were stopped there for this tiresome purpose), these ticket-collectors, I say, must have been robust fellows with lifeboat-men constitutions, indifferent alike to storm, tempest or summer heat.

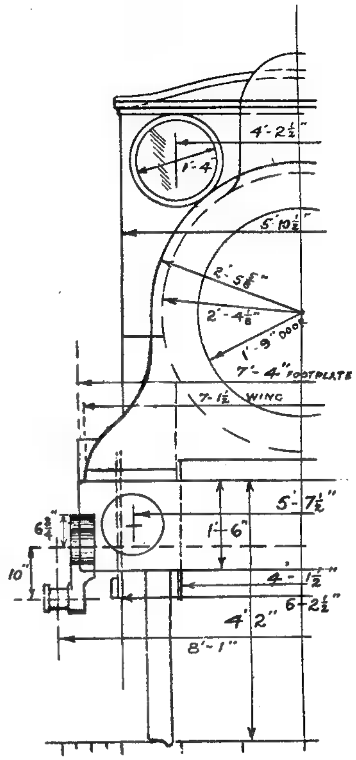
Asia herself had not crossed this remarkable bridge-cum-station many times in her long career, when she saw, in early January of the year 1876, a big yellow engine running through the platforms of "the other line" of Grosvenor Road station. Moreover, this newcomer could claim a certain kinship on the grounds that she too, was a 2-4-0 express engine. Now, as I previously explained, 2-4-0 engines of the double-framed variety were quite in the fashion of the day. Both Kirtley, at the Battersea works of the L.C.D. Rly., and Stroudley, at Brighton, had encountered a numerous collection of such locomotives when they had succeeded Martley

ODELLING by F. C. Hambleton

th Coast Railway—No. 207, "Freshwater"



s ■ *noble-looking locomotive indeed*



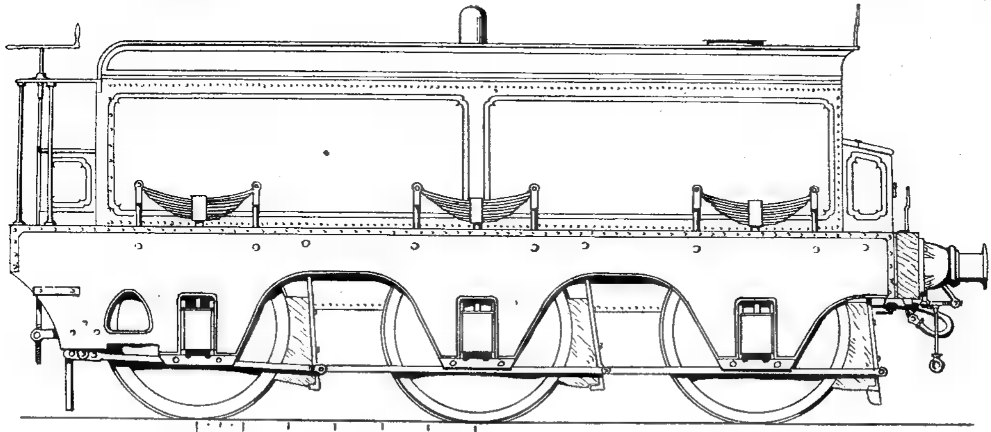
"Freshwater" had a wide and boldly-shaped smokebox wing-plate

and Craven respectively. But whereas Kirtley never favoured this class of engine for his own designs, Stroudley, on the other hand, planned and constructed half-a-dozen such locomotives in his early days, before turning to his own novelties which were ultimately destined to culminate in the famous *Gladstone*.

So here is ■ drawing of the last one of the half-dozen Stroudley 2-4-0's, and I have chosen to introduce her to you here because of her likenesses and differences, and also because she was ■ really noble-looking engine. In dimensions she was much like her Longhedge neighbour—she had a slightly bigger firebox, and her boiler was set up ■ little higher in its frames. This undeniably gave her ■ sturdy appearance, enhanced by ■ shortish and very handome generous-looking Stroudley copper-topped chimney. Her bright yellow colour likewise tended to accentuate her size, especially as her splasher and cab sides were free of such details ■■ springs and spring-hangers. These important items were placed below their axleboxes, and whatever the cleaners thought of them when they came to give the spokes ■ thorough rub down (and remember, in those days, every single square inch of surface was made to *gleam*) this arrangement helped to create an engine of most interesting and pleasing appearance. There was an absence, too, of the frills that were so often to be found on locomotives of her period.

Nevertheless, in spite of her "modernity," she displayed quite ■ number of polished brass or copper fittings, such as safety-valve columns, feedpipes and clackboxes, cylinder lubricators, smokebox blower-valve, window rims, whistle and numberplate—all gleaming in the sun.

Ah! and that reminds me. She had the most delightful of all dateplates (and I should know, for I have the good fortune to possess one of them!). The design was based on that of the numberplate—an excellent idea—and was of



An old Craven tender that carried hot feedwater and ran on solid disc wheels!

This elegant date-plate measured 6 *in. by* $3\frac{3}{4}$ *in.*

brass with raised numerals (notice the quaint seven) set on a blue background. The surrounding lettering was filled with black wax. Truly a delightful thing! It seemed a pity that in 1880, Stroudley superseded it by a rather plain-surfaced one, which henceforth was borne by all his engines.

But, good locomodeller, have a look at the nice old Craven tender attached to our beauty. Solid wheels! Not many engines have had that feature bowling along after them! Think of the effect of those three big yellow slightly dished wheels! It would make an interesting model, wouldn't it? *Asia* must have stared in wonder, and then preened herself. She had a brass maker's-plate on *her* tender!

Useful Dimensions

Wheels, 4 ft. 1 in. and 6 ft. 6 in.
Wheelbase, [illegible] ft. 4 in. and [illegible] ft. 4 in.
Overhang: leading, 4 ft. $2\frac{1}{2}$ in.; trailing, 4 ft. 2 in.
Boiler, 4 ft. 5 in. diameter by 10 ft. 5 in.
Centre above rail level, 7 ft. $1\frac{7}{16}$ in.
Firebox, length, 6 ft. $2\frac{1}{4}$ in.
Cylinders, 17 in. by 24 in.
Heating surface, tubes, 1,022 sq. ft.
Heating surface, firebox, 110 sq. ft.
Chimney, above rail level, 13 ft. 2 in.
Throw of outside cranks, 10 in.
Cab roof above footplate, 7 ft.
Height of sandbox, 2 ft. $7\frac{1}{2}$ in.
Diameter of dome cover, 2 ft.
No. 206, *Carisbrooke*, built November, 1875.
No. 207, *Freshwater*, built December, 1875.

"L.B.S.C."

(*Continued from page* 697)

case-hardened; a simple job. Just heat the eye to redness, and dip it in some good case-hardening powder, such as "Kasenit," "Pearlite" or any other similar brand. Make certain the hole is well filled up; then reheat until all the powder has fused, and the yellow-flame died away, leaving the whole eye bright red. Quench in clean, cold water; scrape off any residue, and clean up. This treatment leaves a hard surface on the steel, which will resist wear indefinitely; but it must not be allowed to run without oil.

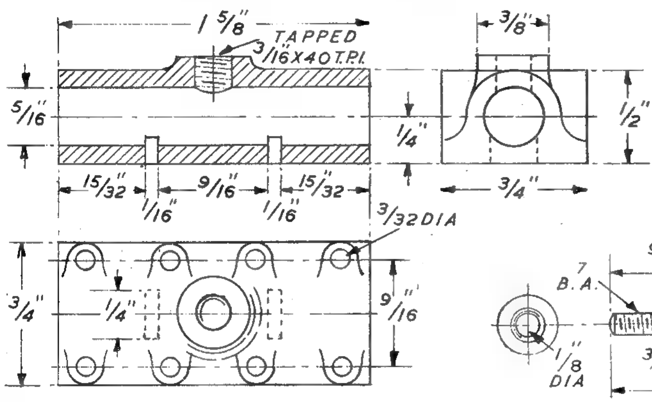
All that remains, is to replace the eccentric-strap on the tumbler, and put the little end of the eccentric-rod in the slot in the pump-ram, securing it by poking the 7/64-in. end of the long pin through the holes in ram and rod, and securing with an ordinary commercial nut. The long end of the pin should project to the right-hand side, as shown in the recently-illustrated plan view. The eccentric should be set on the axle in such a position that it is in step with one of the crankpins in the wheels. This ensures that it will get the full power of one of the cylinders, to force a barrelful of water into the boiler at each stroke, when the bypass valve is closed. We shall fit a bypass valve in due course. To test the pump, all you need do, is to slip a bit of rubber pipe over the suction union, drop the other end in a can of water, and turn the wheels. If you try to stop the flow by putting your thumb and finger over the union on the tee, you'll be astonished at the power behind the water! Next stage, cylinders.

*UTILITY STEAM ENGINES

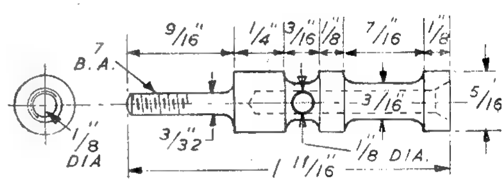
by Edgar T. Westbury

FOR the benefit of readers who prefer piston valves to flat slide valves, details of the alternative components for using the former type of valve are given herewith. It will be seen that the steam chest is in this case a single component, taking the place of the three parts (steam chest, cover and port plate) employed in the flat slide-valve version of the design. This is, at least superficially, an advantage from the aspect of simple construction, especially as it also eliminates the need for a packing gland; case shown, the piston valve is not perfectly pressure-balanced, it will suffer very little from wear over a long period of running, if the right materials are used for both valve and steam chest, and it is kept constantly (though not necessarily copiously) lubricated.

The material recommended for the steam chest is cast-iron, with hard bronze as the next best substitute. Even if it is made from the solid, some attempt at shaping the outside, to reduce weight and improve appearance, is



Left—*Steamchest (piston-valve type)*



Below—*Piston-valve*

but unless one has experience in the construction of such engines, it is not so easy to obtain satisfactory results with a piston valve. Accuracy in the finish of the valve and the bore of the steam chest is absolutely essential; if not initially steam-tight, it cannot be corrected, and will steadily become worse as the parts wear. On the other hand, should the valve be too tight, it will produce much more friction than a flat slide valve (in so small a size) and may be liable to seizure, especially if lubrication is not beyond suspicion. The setting of a piston valve cannot be visually observed and must be adjusted either by measurement or under pressure, neither of which is so easy for the novice as the visual setting of the flat valve.

I would like to point out that these disadvantages of the piston valve are not claimed to be universally applicable to all small steam engines; in a general way they may be regarded as inversely proportional to the size of the engine. Having enumerated them, I will put the case for the other side by saying, that a *properly-fitted* piston valve works with much less friction than a flat valve, especially when working under high-pressure steam; and although in the particular

desirable. Many constructors leave angular slabs and chunks of metal on engine components, simply because it saves trouble in machining; but personally, I am no devoted admirer of "cubist art," and much prefer to see metal only where it serves a useful purpose. Quite apart from the question of weight, or mere appearance, superfluous metal is generally the hall-mark of the slipshod designer and constructor. Some readers may say, "Why worry, so long as it works?"—and of course this is a tenable point of view, but—is it really the only thing that matters?

It is possible to use light alloy for the steam chest, if a cast-iron liner is inserted to take the wear, but the fitting of this is an added complication, and it certainly would not save much weight. Some of the hard heat-resisting alloys, such as Hiduminium RR56, might possibly be used without a liner, as they seem to have much the same character as high-class bronze; but I hesitate to recommend such material in the absence of experience in its use for this particular purpose. One thing I do know is that duralumin is not at all well-behaved at high temperature, especially in contact with steam.

The bore of the steam chest should be machined in the lathe, and after drilling and boring to within a few thousandths of an inch below

*Continued from page 638, "M.E.," November 17, 1949.

finished size, it should be opened out with a D-bit in preference to a reamer, and finally lapped to a high finish. The accuracy should be at least as close as that of the cylinder liners, and to avoid bell-mouthing, the lap should be fairly short, and made capable of expansion to compensate for wear.

The ports in the steam chest, may be produced by end milling, or by drilling four holes $\frac{1}{16}$ in. diameter and chipping out the metal between them with a fine cross-cut chisel. Use a pilot drill first, to reduce the risk of the holes running into each other and breaking the drill; in any case caution will be necessary when opening the holes out to full size. A needle file may be used for finishing the ports, but as only very short strokes are possible, it will be slow work to remove much metal in this way. Concentrate on getting clean, square edges to the ports, and if any error in their width or spacing occurs, the dimensions of the piston valve may be adjusted to suit. A final lapping operation is necessary after the ports are cut.

Stainless steel, which is recommended for piston valves, is made in several grades of hardness, and though the softer "free-cutting" grades (such as KE 40A) are permissible, the high tensile steels such as "Staybrite" give much better wear. They are, however, a good deal more difficult to machine, and the tools must be kept perfectly keen—especially drills—or the metal will glaze and work-harden to such an extent as to overheat and blunt the edge. No great difficulty should, however, be experienced with the small amount of work on this component if due precautions are taken. The idea that stainless steel cannot be machined with carbon steel tools is a fallacy, but obviously the tools must be properly hardened and tempered, and greater precautions taken against overheating than when high-speed steel is used.

In turning the piston valve, the collars or "lands" should be left about 1/1,000 in. oversize for final lapping, and apart from the accuracy in this dimension, the next most important point is the length between the inner edges, and the width of the lands, which must be equal. The third land, at the left-hand end, serves no purpose in steam control, but acts as a guide bearing and prevents exhaust steam blowing out over the valve gear. As the steam is admitted by the inner edges of the control lands, their distance apart must be equal to that between the inner edges of the ports in the steam chest, minus the amount allowed for steam lap. The distance apart of the outer edges of the lands, which control exhaust timing, should be exactly equal to that between the outer edges of the ports in the steam chest, to produce "line-and-line" or 180 deg. exhaust timing. By using inside admission, the central exhaust port in the steam chest is eliminated, and the port in the engine body (originally designed as the mixture inlet in the c.i. engine) is no longer used as an exhaust port; the exhaust steam passes out at the end of the steam chest, and an exhaust pipe may be attached here by a flange or union joint.

It is an advantage to turn a couple of fine grooves with a point tool in each of the control lands, and three or four in the guide land; these may only be very small, but even a mere scratch will assist in holding oil and improving steam packing. A ring lap should be used for finishing the lands; it should be split, and held in a carrier or die-holder to enable it to be contracted.

As soon as the piston valve is lapped sufficiently to push stiffly through the steam chest, it should be cleaned thoroughly of all traces of abrasive, likewise the bore of the steam chest, and worked into the bore with plenty of oil and a trace of *paste* metal polish or plate powder, until it moves quite freely. For setting the piston valve by measurement, the distance from the open end of the steam chest to the end of the valve should be carefully measured with a depth gauge, (*a*) when it is in the middle of its stroke (i.e. with both steam-chest ports only just barely covered by the outer edges of the control lands, (*b*) with one port just being opened to steam by the inner edge of the land, and (*c*) with the outer port similarly opening to steam. A slip of thin metal foil may be used as a feeler gauge to find the exact opening points. The exact measurements in each case should be carefully noted; in full-size practice, it is usual to make permanent gauges of wood or metal (commonly known as "battens") to check valve settings, and one might do much worse than follow this practice here.

When adjusting the running position of the piston valve, it is necessary first to find the exact mid-stroke of the eccentric, which may be done by taking tentative measurements at the two ends of the stroke, and halving the distance between them; the collar on the valve stem is then set so that this position coincides with measurement (*a*). The crank is then turned to the t.d.c. position for one cylinder, and the eccentric set to bring the valve into position (*b*) or (*c*) as the case may be, then temporarily locked. Check up the other port by turning the crank to the opposite dead centre (note that it must always be turned in the required direction of rotation) and should any discrepancy in the measurement be observed, "split the difference." As with the flat slide valve, a few experiments may be found desirable before finally fixing the eccentric.

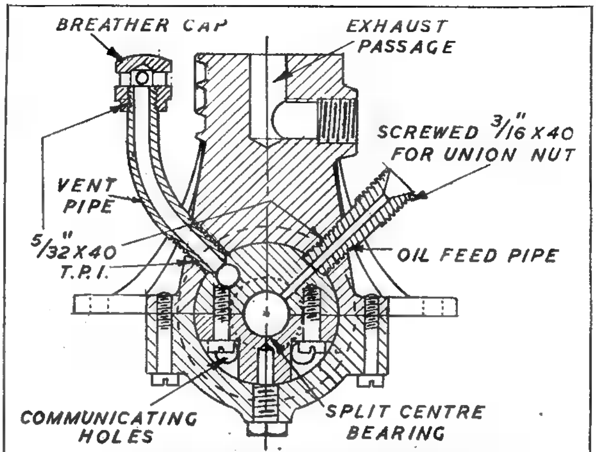
In order to set the valve under pressure, the engine must be fully assembled and connected to a steam or air line (the latter for preference, as it is much easier to handle the adjustments cold than hot) at a few pounds pressure. The engine is slowly turned by hand, and if one listens carefully, the exact point at which the steam port opens into either cylinder can be detected by the hissing sound. This method is often preferred by experienced hands, but is not too easy for the inexperienced novice.

"Breathing" and Lubrication

In an enclosed engine of any kind, some provision must be made for ventilating the crankcase and also keeping up lubrication of the internal parts. Both these essentials are looked after very well in a small two-stroke i.c. engine by passing the mixture, charged with oil, through the crankcase; but a steam engine cannot take advantage of these simple measures and some alternative must be provided.

First of all it should be pointed out that the

division of the crankcase into two separate sealed compartments is now unnecessary, and it is better to put these into free communication with each other by drilling holes through the split centre bearing. It would indeed be possible to dispense with this bearing altogether, by stiffening up the centre part of the crankshaft, but I do not recommend this, as the crank throws are a good way apart, and in the circumstances, a steady bearing in the centre of the shaft is a great advantage. The ventilation of the crankcase may be provided for by drilling a radial hole from the outside of the body casting, into one of the holes in the centre bearing, and fitting an escape pipe, bent vertically at the outer end. In this position, the vent will be out of the way of any oil thrown off the cranks, and spray or dribbling thereby prevented. A breather cap may be fitted to the outlet, as shown.



The lubricating and ventilating arrangements for the "Humming Bird" engine

Lubricating oil can be fed to the centre bearing by a similarly disposed pipe on the opposite side of the body, but in this case leading directly into the bearing itself, and an oil-way in the latter will enable oil to be carried into each crankcase compartment and thrown out by centrifugal force, so as to reach all working parts. A better scheme still would be to drill the crankshaft so that oil is fed directly to the big-end bearings, but this would be a rather delicate drilling operation in so small a shaft, and should not be undertaken unless one is confident of the ability to carry it out successfully, as failure may result in ruining the crankshaft. Incidentally, if one is building the engine throughout as a steam engine, a fabricated shaft will be quite satisfactory, as the maximum stresses to which it will be subjected are very considerably reduced, as compared with those in a c.i. engine.

The compactness of the crankcase space precludes the possibility of carrying any substantial quantity of oil therein; not that it would be any very great advantage, as splash lubrication in small high-speed engines is a very dubious policy, and in all steam engines, it is practically impossible to avoid a small amount of condensate passing the pistons and mixing with the oil in the crankcase, the usual result being to churn the contents into an unwholesome sludge, which is more effective in rusting up the parts than lubricating them. On the whole, I think it better to keep the engine constantly fed with a small quantity of clean, fresh oil by means of a drip-feed or similar device, and after each run, inject a good shot of oil while the engine is hot, before condensation has a chance to deposit water on the working parts; this treatment should be extended to the upper works as well as the crankcase.

It may be observed that the advantages of enclosing a steam engine are very questionable, unless one can guarantee that condensate can be prevented from accumulating inside the crankcase; the open engine, though possibly more difficult to lubricate at high speed, at least has the advantage that water does not permanently remain in contact with the parts, and any corrosion which may be set up is likely to be noticed before it has done any serious damage. In this respect, the use of ball-bearings in steam engines is also a dubious advantage, as it is difficult to ensure that they are completely sealed or protected against the entry of water, which is an even more insidious enemy to ball-races than to plain bearings, and the slightest pitting will ruin them completely.

It is hoped that the particulars of this little enclosed engine will be found useful not only to those who wish to adapt the castings of the "Ladybird" engine in the manner described, but also those who may be designing other forms and sizes of the popular twin single-acting engine which has been the prime favourite among builders of fast prototype boats for many years.

The engine described will produce ample power for propelling a fairly fast launch of about 30 in. length, or larger boats at proportionally lower speeds, if supplied with steam at 80 to 100 lb. pressure from a suitable boiler, such as the Stuart Twin-drum Minor water-tube type fired by a spirit vaporising lamp or a small blowlamp. While the engine is quite flexible and may be run at slow speeds, it is happier when running fairly fast, and living up to its title.

Correction

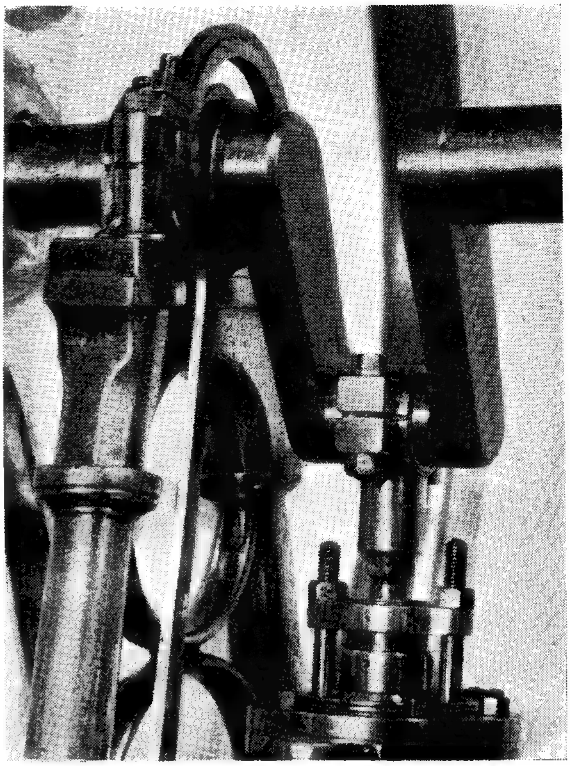
A rather absurd little mistake has crept into the drawings of the steam chest of this engine, which is shown as having a blind rear end; but it will be noted that this makes it impossible to assemble the slide valve-rod unless the collars on the latter are made detachable. The remedy is simple; bore out the rear end of the steam-chest to 5/32-in. diameter and tap it $\frac{3}{16}$ in. $\times$ 40 t.p.i. to take a screwed blind-ended bush, bored 3/32 in. diameter.

(*To be continued*)

Another

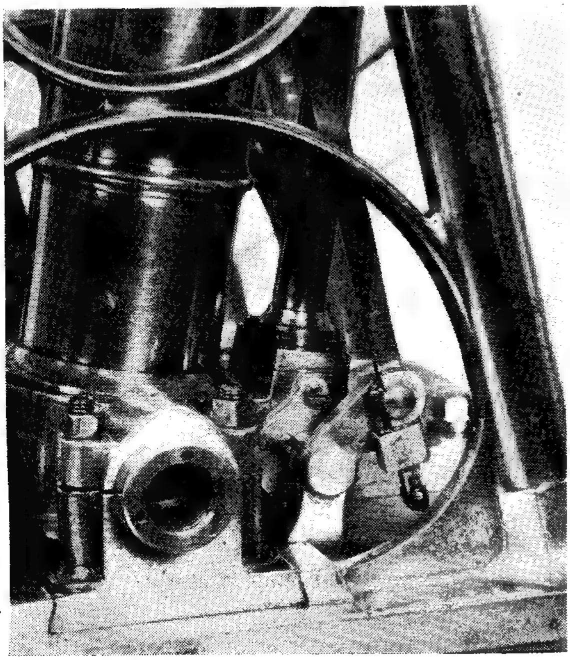
"Unknown"

A beautifully constructed model about the history of which nothing whatever is known



FROM time to time, we come upon models about which nothing is known of their history. One such is the subject of three photographs, one of which is reproduced on the cover of this issue, and the other two on this page. They depict what appears to be a very fine model of an oscillating engine, the prototype of which may have been used for some such purpose [illegible] driving [illegible] mill.

The model belongs to Mr. C. J. Howlett, though it is at present on view in the window of our office building in Great Queen Street. Except for the crankshaft, eccentric-rods and piston-rods, which are of steel, the model is made of hard brass, or bronze castings and displays some beautiful workmanship.



One of the photographs shows a near view of one of the cranks and an eccentric, while another shows a main trunnion bearing, on which the cylinder oscillates, and the lower end of [illegible] eccentric-rod. The point of interest about the latter is the semi-circular clip which bears on a pin attached to the outer end of an oscillating arm, by means of which the valve is operated. The model stands on a stout steel plate mounted on a polished wooden base.

The flywheel is keyed to one end of the crankshaft and will be seen to have unusually slender spokes; it is $15\frac{1}{2}$ in. in diameter and has [illegible] rim 1 in. by 1 in.

Perhaps, some reader may recognise the model and could supply some details of its history; if so, Mr. Howlett and ourselves would be glad to hear from him.

IN THE WORKSHOP

by "Duplex"

51—Further Additions to the Lathe

ALTHOUGH the fittings described in this article were made for [redacted] Myford M.L.7 lathe, they [redacted] mostly be applied, where needed, to lathes of other makes by altering the dimensions or modifying the details of design shown in the drawings.

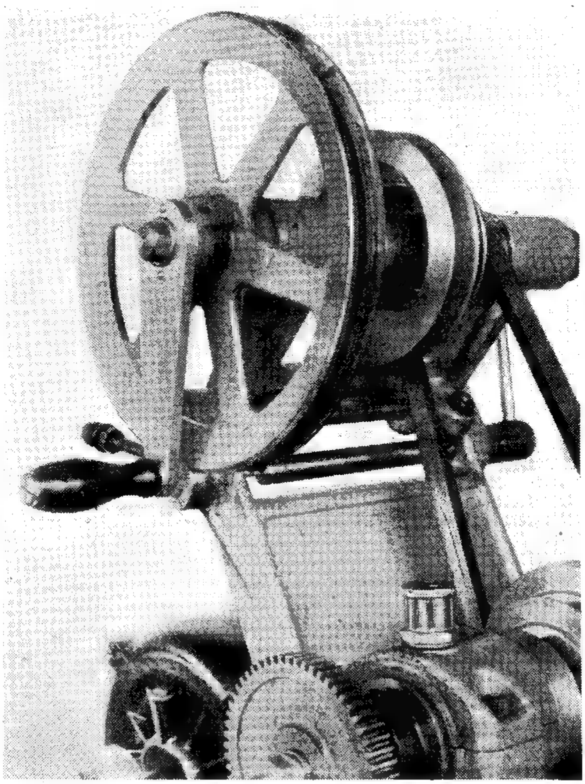


Fig. 1. The mandrel handle fitted to the lathe countershaft

A Mandrel Handle

There are occasions, such [redacted] when cutting short lengths of screw thread, when the worker finds it more convenient to turn the lathe mandrel by hand rather than to use mechanical or foot power. In the days when the lathe was driven from a countershaft by [redacted] long belt, this was not [redacted] difficult matter ; but nowadays, a self-contained motor driving unit means a very short belt which, in turn, affords ample opportunity for pinching the fingers if the belt is pulled round by hand.

Our own early lathes had no back gear, and to overcome the difficulty of machining iron castings, a handle, colloquially known as a donkey handle, was fitted to the tail of the mandrel.

Even where the lathe has a back gear, this fitting will be found useful when threading work with the tailstock die-holder or when cutting short lengths of thread from the leadscrew, for the motion so imparted is sensitive and can readily be checked [redacted] soon as any excessive resistance is felt or when screw cutting up to [redacted] shoulder.

As illustrated in Fig. 1, the modern form of drive further lends itself to this addition, for when the handle is fitted to the countershaft, the back gear can still be used to obtain greater torque and, in addition, the reduction of the drive ratio by means of the step-pulleys is at times an advantage.

Although the making of the attachment is [redacted] quite straightforward piece of work, there are a few points in the construction that may be noted. In the first place, with the parts dismantled, the normal lathe drive cannot, of course, be used, so that if the face of the boss on the countershaft pulley needs facing, either another lathe must be employed, or the pulley can be mounted on [redacted] stub mandrel gripped in the lathe chuck, and the facing tool is then fed slowly inwards [redacted] the pulley is rotated by hand. It may be found possible to drill the end of the countershaft to receive the central clamp-screw by employing the drilling machine. If there is sufficient clearance below the machine, as in [redacted] pedestal-mounted drilling machine, an angle-plate is secured to the drill table for the attachment of V-blocks or a machine vice to carry the shaft. In this way we have been able to end-drill shafts that were too long to be accommodated in the lathe.

The two taper driving pins should be fitted on the long axis of the crank web, otherwise the part will be weakened unnecessarily. Care should be taken to mark-out and drill the web accurately, so that, when it is bolted to the pulley to serve [redacted] drilling jig, the holes formed will be symmetrical and will allow the handle to be fitted in either position ; it is [redacted] sign of indifferent workmanship and a source of annoyance to the user if parts such as these can be assembled in one position only.

The ordinary sewing-machine handle, which is made of hardwood, gives [redacted] comfortable finger grip and should be fitted so that it rotates freely on its crankpin ; alternatively, the handle can be made from ebonite rod. When this material is used it may, if desired, be highly polished by mounting the finished handle on [redacted] stub mandrel secured in the chuck of [redacted] high-speed drilling machine. Fine emery-cloth or glass-paper will then give the surface [redacted] smooth matt finish, but great care must be taken to avoid heating the work, or its surface will be roughened and torn. The surface is finally polished by working [redacted] piece of soft rag, moistened with liquid metal polish, up and down the handle [redacted] it rotates at high speed ; this is continued until all scratch marks have been removed.

It will be observed that taper pins [redacted] fitted to the web to prevent it turning on the pulley. Although, if preferred, parallel pins may be used, taper pins [redacted] more easily made [redacted] firm press fit in the web and at the same time a close fit in the pulley.

Moreover, these fits can be adjusted, when required, solely by the [redacted] of the taper reamer, and, in addition, parts so fitted together can be dismantled more readily than when furnished with parallel pins.

Reference has already been made to the importance of end-locating the gib strips fitted to machine slides, and it may be remembered that it [redacted] pointed out that a gib-strip located solely by its adjusting screws, is able, by virtue of the working clearance present, to [redacted] slightly endwise whenever the direction of the slide's travel is reversed. This results in [redacted] taking place at the points where the adjusting screws make contact with the gib, and the effect is to throw the slide out of adjustment much [redacted] than would be the case were the gib constrained endwise.

In the M.L.7 lathe to which this addition [redacted] made, it [redacted] found that the gib-strip at its front end was just short of the slide casting. This necessitated making the forward locating-piece L-shaped as illustrated in Fig. 4. This component is best made from the solid and filed to fit neatly in place when secured to the cross-slide casting with a $\frac{1}{8}$-in. Whitworth cheese-headed screw. The short limb of the L-shaped part is made a few thousandths of an inch over length in order to afford a means of adjustment when fitting the component to the slide.

As the rear end of the gib-strip lay exactly flush with the surface of the cross-slide casting, [redacted] flat piece of material was all that [redacted] necessary for making this locating member.

This part can either be specially made for the purpose or, [redacted] shown in Fig. 4, [redacted] ordinary chamfered washer may be used, and is secured in place with [redacted] cheese-headed or a countersunk screw.

The gib locating components should be fitted with the slide removed, but with the gib in place ; the adjustable member is then set so that although the strip can be tipped with the fingers, it is firmly supported in [redacted] endwise direction.

In [redacted] workshop, which at one time we supervised, it [redacted] found that adjustment of the gib

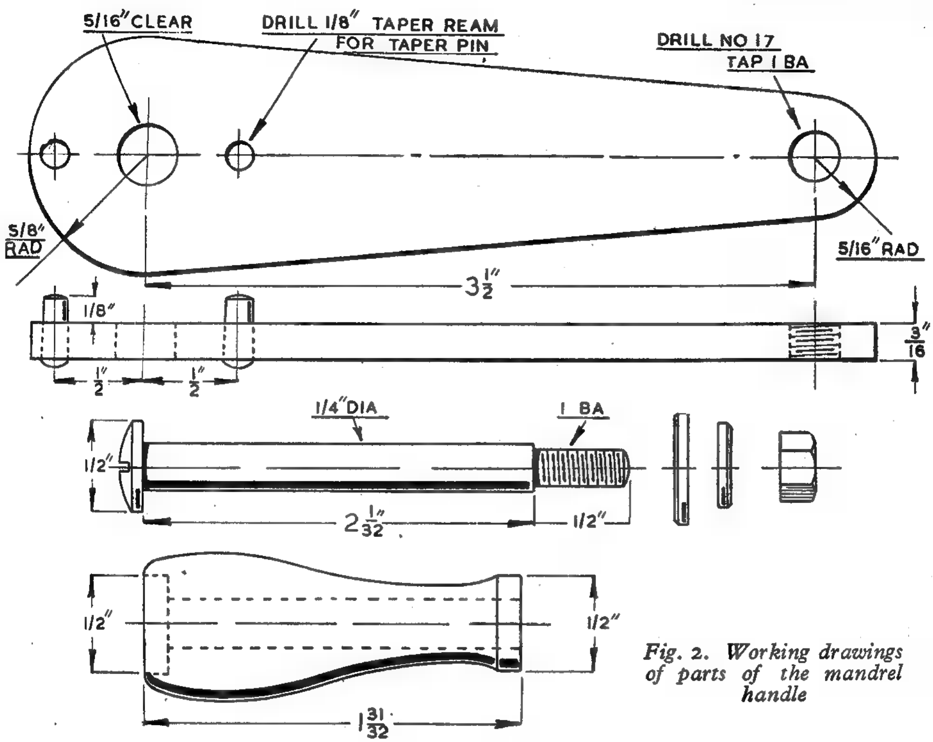


Fig. 2. Working drawings of parts of the mandrel handle

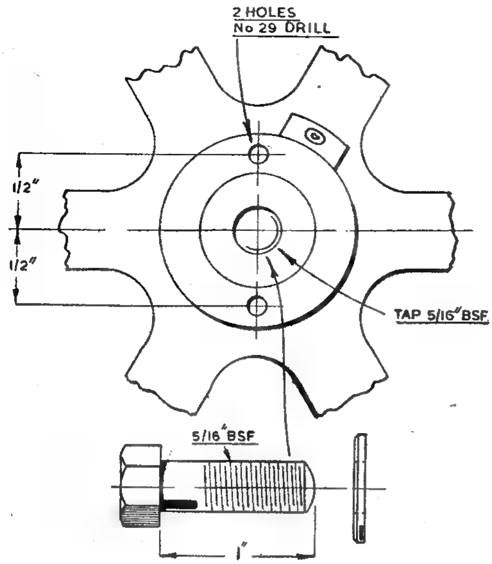


Fig. 3. Showing the end face of the pulley and countershaft with the handle fixing-screw

strips fitted to the slides of the machine tools called for frequent attention if accurate production was to be maintained, but after the strips had been properly end-located, readjustment was seldom required.

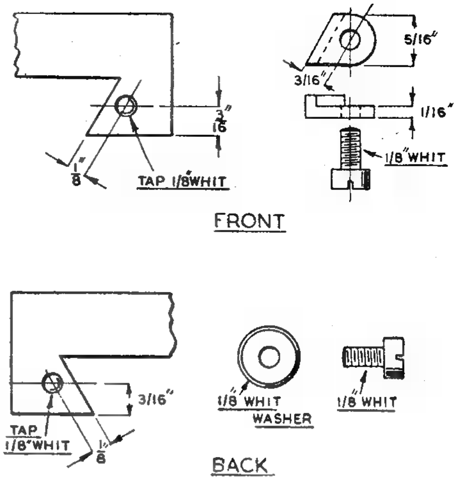


Fig. 4. The fittings for end-locating the gib-strip

Fitting Locking-screws to the Slides

The advantages of fitting locking-screws to the lathe top-slide and cross-slide have already been pointed out. Briefly, these are that greater rigidity is obtained when those slides not in actual use are firmly clamped, whilst moderate tightening of these screws will add sufficient friction to the working of the slide to prevent a milling cutter grabbing and drawing the work too deeply into

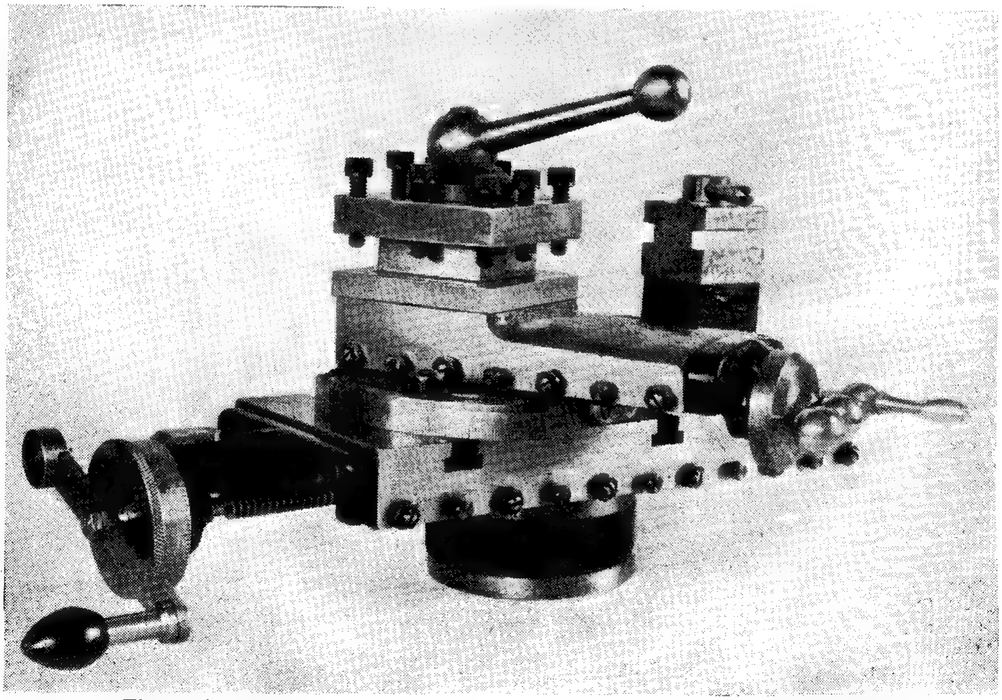


Fig. 5. Showing the positions of the locking screws fitted to the top- and cross-slides

cut ; moreover, by this means, [redacted] parting tool with [redacted] large angle of top rake will be restrained from digging in and jamming in the work.

If, on the other hand, the gib adjusting screws are used for these two purposes, their setting is lost and readjustment of the gib will then be necessary, whereas the locking-screws are quite separate, and when they are released the original adjustment of the slide is regained.

The photograph, Fig. 5, shows how these locking-screws have been fitted to the top- and cross-slides of an M.L.7 lathe, and it will be seen that they [redacted] evenly spaced between the gib adjusting screws in accordance with the working drawings given in Figs. 6 and 7. The ends of the locking screws are made coned to [redacted] included angle of some 90 deg. to ensure that only the tip of the screw makes contact with the gib-strip.

The heads of the screws may either be made round and cut with a screwdriver slot, or they may be of hexagon form ; but as the second screw from the front of the cross-slide lies under the overhanging top-slide, it may be found more convenient to tighten it with [redacted] screwdriver, and a slot should, therefore, be provided for this purpose. As only light screw pressure is required to lock the slide, [redacted] short box spanner, fitted with [redacted] knurled head to afford [redacted] finger grip, will be

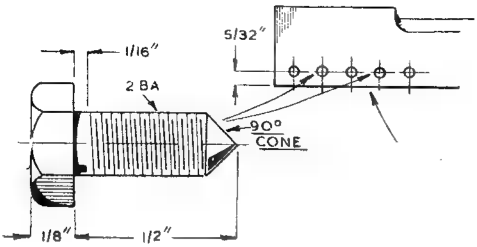


Fig. 6. *The top-slide locking screws*

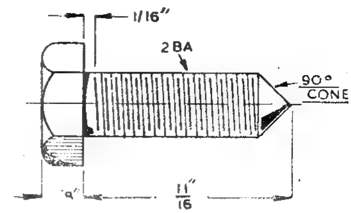


Fig. 7. *A cross-slide locking screw*

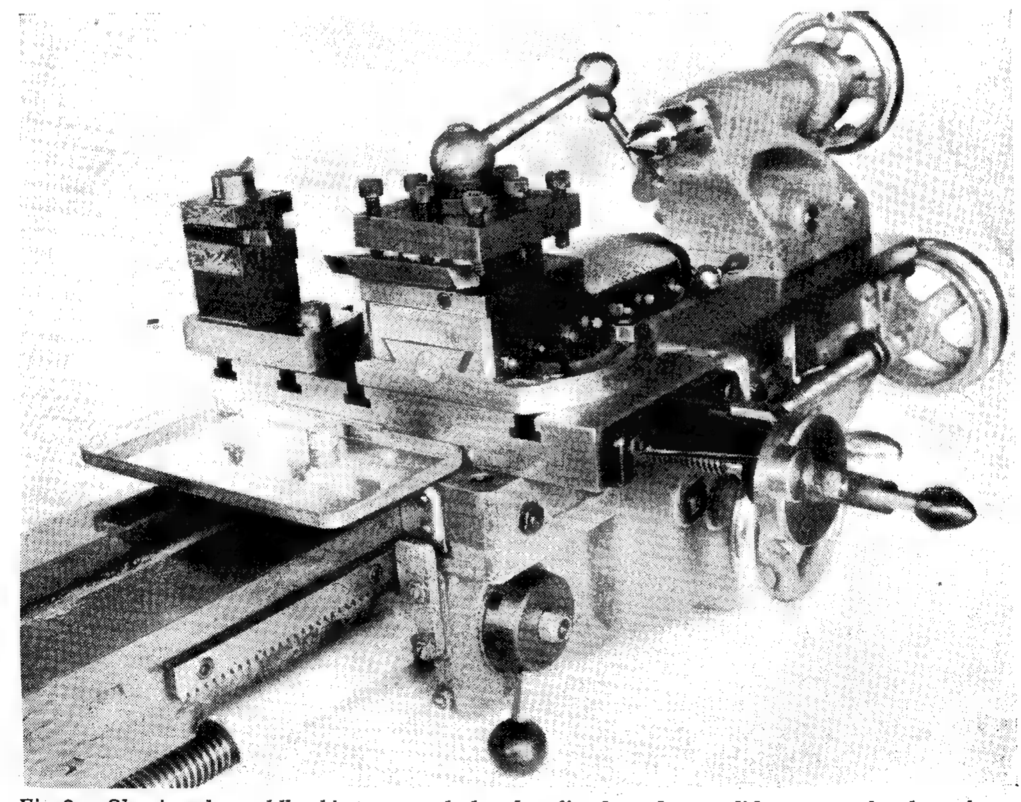


Fig. 8. *Showing the saddle chip tray and the plug fitted to the top-slide turret : the short clasp-nut lever : and an additional top-slide bolt*

sufficient for tightening the hexagon-headed screws.

It should be pointed out that on no account should any screws be tightened that bear on a portion of the gib-strip unsupported by the saddle casting, for this may easily cause bending of the gib itself.

To give the screws a finished appearance in keeping with the gib adjusting screws, they should be blued by carefully controlled heating followed by quenching in oil. For the sake of appearance also, the practice used in instrument work can be adopted in this instance, that is to say the screw holes are counter-drilled to the clearing size for a short distance, and the neck of the screw is left plain so that no part of the thread is visible when the screw is fitted in place.

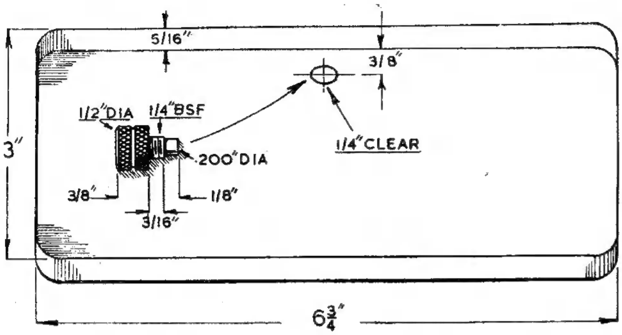


Fig. 9. The chip tray with its fixing screw

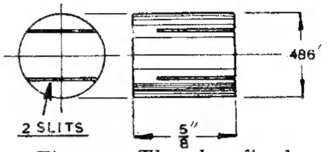


Fig 10. The plug fitted to the top-slide turret

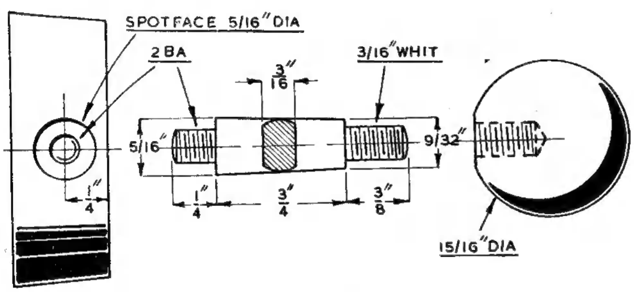


Fig. 11. The alternative form of clasp-nut lever

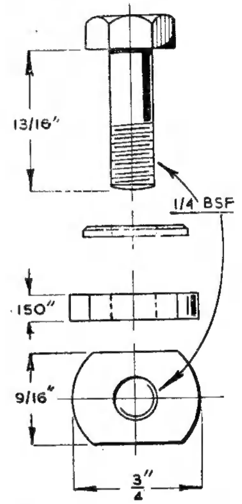


Fig. 12. Extra bolts for securing to top-slide

Chip Guards

If, as shown in Fig. 8, a chip-tray is carried on the saddle, not only will the lathe bed be kept free from turnings, but, when cleaning the surface of the cross-slide, the chips can be swept with a small brush into the tray and thus removed without falling on to other parts of the lathe.

The tray shown was made from the lid of a cigarette tin, 6¾ in. long, 3 in. wide, and $\frac{5}{16}$ in. deep, and is retained in place by a knurled finger-screw engaging in one of the holes provided for fixing the travelling steady.

To ensure easy insertion, this screw should have its tip reduced for a short distance to the core diameter of the thread.

The lacquered finish applied to the tin can be removed by rubbing with a rag moistened with either methylated spirit or amyl acetate, according to the type of paint used ; if a little liquid metal polish is added at the same time, its slightly abrasive action will hasten the process and will give a good finish to the underlying tinned surface.

An alternative method of making chip-trays is to use aluminium sheet beaten to shape over a wooden former, but this soft metal is easily dented in use, and its surface becomes scratched when steel turnings mixed with cutting oil are cleaned off.

Reference to the photograph will also show that a plug has been fitted to the tunnel housing the feedscrew of the top-slide ; this is to prevent chips entering, and is more sightly than a cork or a piece of rag.

The dimensions of the fitting are given in Fig. 10 and its length is such that the plug is pushed out by the final $\frac{3}{16}$ in. of the feedscrew travel, thus enabling it to be removed with the fingers. The plug is slit in two places to afford it a light frictional grip in the top-slide tunnel.

An Alternative Form of Clasp-nut Handle

As the owner of this lathe alleged that, when operating the lever controlling the leadscrew clasp-nut, hot metal turnings were apt to fall on the back of his hand, it was decided to both shorten and alter the position of this lever. The new lever, shown in the photograph. Fig. 8

is so positioned that it lies vertically when the leadscrew nut is opened. As the mechanism for actuating the clasp-nut works freely and smoothly when the gib strip fitted to the nut slide is correctly adjusted, a short operating lever will be found adequate to give good control.

The lever arm is made from a piece of $\frac{3}{8}$-in. $\times$ $\frac{3}{16}$-in. mild-steel strip, and after it has been marked-out in accordance with the working drawing, Fig. 11, the end portions are cut to shape with the aid of hacksaw and file to a little in excess of the finished diameter. The lever is then centred in the four-jaw chuck for turning the end portions to size and threading them by means of the tailstock die holder.

Finally, the lever is filed to tapered form and its surfaces are finished by draw-filing with a fine file.

An ordinary commercial pattern knob was fitted in this instance, but, if preferred, this part can be turned from ebonite rod and then polished as previously described.

The cone-shaped member which actuates the two halves of the clasp-nut will have to be re-drilled and tapped to receive the lever in its new position. This part is, therefore, marked out in accordance with the working drawing and, while gripped in the machine vice, it is deeply drilled with a centre drill ; this is to form a large guide centre in order to prevent the drill point wandering on the sloping surface of the work. A hole is then drilled to accommodate the guide-peg of a $\frac{5}{16}$ in. diameter pin-drill so that a flat seating can be machined for the lever to butt against. This hole is next opened out to the tapping size with a No. 24 drill and finally threaded 2-B.A. It is, of course, essential, for the sake of appearance, that the lever should lie with a flat surface facing outwards, and any adjustment in this respect can be made either by remachining the flat lever seat with the pin-drill, or by careful filing of the abutment faces of the lever itself.

Additional Holding-down Bolts for the Top-slide

Although reassured to the contrary, the owner of the lathe appeared to have some doubt as to the rigidity of the fixing of the top-slide to the cross-slide by two T-bolts only.

It was decided, therefore, to make two extra bolts which could be fitted if required, but it was pointed out that the angular movement of the top-slide would then be restricted.

One of these extra bolts can be seen in the photograph, Fig. 8, where it appears nearest to the camera.

To allow of easy removal, in order to swivel the top-slide, these bolts are fitted in the reverse position, that is to say, as shown in the working drawings, Fig. 12, the nut-piece lies in the T-slot and the bolt itself is inserted from above.

To make them in keeping with their fellows, the bolts are given a blued finish obtained by heating and quenching in oil.

Should greater holding power be considered advisable, the nut parts can be made in the form of an inverted T, with the vertical limb projecting upwards in the narrow portion of the T-slot.

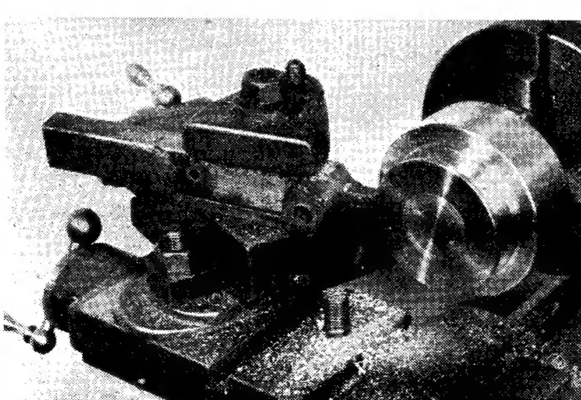
When this form of construction is adopted, the thickness of the nuts can be increased to $\frac{5}{16}$ in., and the nuts themselves machined to shape either by a milling operation in the lathe or by employing the shaping machine.

Turning Tapered Grooves

by J. W. E. Message

WHEN about to turn a starting-cord groove of 40 deg. included angle in a model petrol engine flywheel, it was found that the top-slide of my Myford M.L.4 lathe would not swing over sufficiently. The difficulty was overcome in the following manner :—

The top-slide and its pivot bolt were removed. A tee-bolt was fitted in a convenient tee-slot on the cross-slide, and the top-slide was clamped to the tee-bolt by means of its existing pivot hole, as shown in the accompanying photograph.



This arrangement allowed a greater degree of set-over, and with the combination of back gear, a narrow round-nosed tool, and light cuts, the job was completed without any signs of chatter.

This method could also be used when turning motor and countershaft pulley grooves, etc.

PRACTICAL LETTERS

International Racing

DEAR SIR,—Believing Mr. Mitchell, of Runcorn, to be a popular and well-respected member of the model power boat fraternity, it was with great surprise that I noted a certain bitterness and scorn in his letter headed "International Racing," "M.E.," November 10th issue.

However, I will endeavour to answer him and the other critics without attempting to justify my article.

First, he is quite right in suggestion a new title of "How I Won the Swiss International"; this was my intention, the observations of the Swiss hospitality and incidentals leading up to the final result were included to add interest. Having sacrificed a lot to scrape together the expenses for the Swiss trip, I felt that the results justified my writing about it.

The acknowledgment to Dooling Bros. has been made to them personally for producing such a fine piece of model engineering perfection to assist the more helpless enthusiasts like me.

The Stars and Stripes on the hull as suggested by Mr. Mitchell could also serve as an appreciation of those "Yankee Boys" who lost their lives with their English-speaking comrades to make our ponds and pastime safe, some of them were, perhaps, power-boat fans.

I cannot, however, concede 90 per cent. of the credit to America; this is not an isolated case of a Briton winning international events with a foreign engine, as an example :—

In 1914 when Howard Pixton won the Schneider Trophy and set up a world record in the Sopwith Tabloid, he used a French Gnome engine. The French firm consoled themselves with a little reflected glory amounting, I believe, to about 40 per cent.

In my case a lot of the credit goes to a few genuine and unselfish power boat enthusiasts who have helped and advised in my experiments. The names of Basil Miles and Charlie Cray of the Malden club are foremost; without their help I could not have achieved my 10 per cent. in so short a time.

Messrs. K.L.G. with their glow-plugs, Messrs. Phenoglaze with their paint and Messrs. Barter Trading Co. with their "Beetle" glue have all helped.

The mixed reception my 10 per cent. successes have had with the "experts," prompts me to quote from Emerson's Essay on Art :—

"Therefore each work of genius is the tyrant of the hour."

I am no genius and had my progress been a little slower, and dignified speeds of about 40 m.p.h. been attained, I would most likely have been accepted as a reasonable sort of chap with perhaps big ideas, instead of, what you will, a big head and lots of luck.

My enthusiasm for the Swiss boys and their hospitality was sincere, and called for no comment about English hospitality, a sample of which I was lucky to receive recently at the hands of that popular Bournville stalwart, Ken Williams, his club mates and members of the Derby club. In passing I would record for the benefit of Messrs. Mitchell and Curtis that in spite of indifferent weather and choppy water, I was fortunate in keeping my hull, *Lady Babs II*, on the water to register a speed of 67 m.p.h. over 500 yards, again, of course, with acknowledgment to Doolings.

I also have a hull fitted with a stock British engine that is performing well and would welcome a match with any other hull fitted with the same motor. As an alternative, I will loan Mr. Mitchell my Dooling to put inside one of his well-designed boats to see if the results justify his most unworthy attack on my efforts in winning the Swiss and French Internationals.

When, with studied modesty, Mr. Mitchell writes his article on winning an *International* International, it will be interesting to note my comments. Until that time it would be better to forget the whole thing and get back to our hobby. Constructive criticism is a good thing, let us not drift into expressions of personal feeling that could be misinterpreted.

Yours faithfully,

Sunbury-on-Thames. G. H. STONE.

Preventing Twist Drill Breakages

DEAR SIR,—I have recently been making considerable use of some of the smaller twist drills available, ranging between Nos. 60 and 80, and found that the breakage incidence was getting far in excess of the depth of my pocket.

After a little cogitation, I evolved the following scheme, which although probably far from new, may be unknown to some of my fellow readers of THE MODEL ENGINEER. I bought an "Eclipse" pin-vice—I found the No. 2 size most suitable—cleaned out the hollow stem with a D-bit until the bore was smooth.

I then found in my junk box the taper shank of a drill, which I softened and drilled out to take a spindle the length of the pin vice stem and diameter suitable to slide into the pin-vice bore.

In use, this is fitted into the tailstock barrel, the pin-vice slid over and the tailstock brought up until the drill held in the pin-vice jaws almost touches the work held in the lathe chuck.

I find that the sensitive feel thus given will prevent a large percentage of the breakages previously experienced. I found it advantageous to remove the knurling on the pin-vice stem for a sufficient distance to enable the forefinger and thumb to hold on, thus with a light grip, the pin-vice will spin rather than break the drill.

The drill is, of course, fed to the work by sliding along the spindle, keeping the tailstock barrel stationary.

Yours faithfully,

Bristol, 4. F. E. LOVETT.

Whose Launch?

DEAR SIR,—I would like to thank you and the correspondents for helping me to sort out "my launch" particularly Mrs. D. Rowland of Leatherhead for her kind offer, although I fear it will be "many moons" before I could avail myself of this.

I think, the steamer I saw must have been the *Erg*, as the description, grey-painted clinker-built, and the short name fits my impression.

Also, if there is a connection between the *Erg* and Mr. Rowland's boat as you suggest, what about an article with maybe a picture, as I believe this would answer your following paragraph in "Smoke Rings" under heading "What use is it?" (August 4th).

However I think we should be warned, and not let Mrs. Rowland have anything to do with it ("Snivelling little steamer," indeed!).

Yours faithfully,

Hayes. R. NICHOLLS.

CLUB ANNOUNCEMENTS

The West London Model Power Boat Club

For the first time this year we are inaugurating a winter season. Meetings at the pond-side will take place once a fortnight, which started on November 6th and will continue until March 26th next year, including the competition for the Andrews Trophy on January 1st, 1950, ice permitting.

The events will be alternately an "end-to-end" competition and a round-the-pond race. The object of the end-to-end is to send a boat up and down the pond, from west to east and back again, without touching it except to turn it round. Starting with 20 points, one is lost each time a course has to be corrected. We look forward to some competition in the winds and fogs to come.

York City and District Society of Model Engineers

The annual general meeting of the above society will be, held at No. 12 Room, Co-operative Hall, Railway Street York, on December 10th, 1949, at 6.30 p.m. All members are requested to be present.

Hon. Secretary: W. SHEARMAN, 28, Terry Street, York.

Brighton and District Society of Model and Experimental Engineers

Owing to the arranged lecture being unavoidably cancelled, our chairman, Mr. P. Weil, stepped nobly into the breach at a few hours' notice and provided the meeting of November 7th, with a most enjoyable evening. His subject was his steam-driven paddle boat, which was present, and waterborne in a large testing tank provided by Mr. G. H. Davis. Mr. Weil gave a very interesting talk on the building and performance of his boat after which he raised steam and she chugged merrily away in the tank. The removal of the superstructure so that the engines could be seen running was greatly appreciated by all. Mr. Weil is very anxious to enlarge the ship section of this society which is still going all out to secure workshop premises for the club equipment.

Hon. Secretary: H. G. ACHARD, 48, Aldrington Avenue, Hove, Sussex.

Harrow and Wembley Society of Model Engineers

The visit by Mr. J. Austen-Walton, which had been eagerly awaited for some weeks, took place on November 9th at Heathfield School, College Road, Harrow.

Mr. Austen-Walton, who came all the way from Worthing for the occasion, gave a most interesting talk on small locomotive construction. He went over many of the features that he incorporated in his famous engine "Centaur" and enlarged on some details of the 0-6-0 L.M.S. tank locomotive which he is now describing in two versions in current issues of THE MODEL ENGINEER. "Major" refers to a highly-detailed small edition of the L.M.S. prototype, which he is building himself as his published description proceeds, and which he brought for members to see, and "Minor" is a simplified version of the same model, similar in outward appearance but more within the scope of the less ambitious worker. When the meeting closed, it was obvious that many questions remained unasked and it is very much hoped that Mr. Austen-Walton will pay the society another visit as his time permits. The meeting was one of the best attended this year.

Hon. Secretary: J. H. SUMMERS, 34, Hillside Gardens, Northwood, Middx.

Doncaster Model Engineering Society

The annual exhibition of the above society was held in Doncaster on Saturday, October 29th. The president of the society, Mr. Bramley, B.Sc., A.M.I.M.E(Mech.), opened the exhibition and we had the pleasure of the company of members of the Sheffield, Rotherham and Gainsborough societies. Mrs. Bramley presented the club cups to the winners, and the staffs of the engineering concerns in the district, who were invited, greatly appreciated the workmanship of the exhibits.

Our winter programme is in preparation.

Hon. Secretary: W. BEGG, 6, Westmorland Street, Balby, Doncaster.

South London Model Engineering Society

The society has now joined the Beaufoy Technical Institute, Black Prince Road, Kennington, S.E., where each Wednesday evening, at 7.30 p.m. they will hold their meetings. This will be of definite advantage to every member, enabling him to attend lectures and demonstrations by the society on the Wednesday club night and to use the workshops of the Institute on any week night.

The usual alternate Sunday morning meetings will be held at King's College Sports Ground, Dog Kennel Hill, East Dulwich, S.E.

Hon. Secretary: W. R. COOK, 103, Engleheart Road, Catford, S.E.6.

The North London Society of Model Engineers

Our fifth anniversary was celebrated on Friday, November 4th. At a special meeting we enjoyed a colour film and gramophone records which have been made of highlights in the society's history. Our founder members told the story of the beginning of the society, whilst the president spoke of the future. A telegram conveying the sincere good wishes of the meeting was sent to our very good friend and patron, "L.B.S.C."

The next general meeting will be held at the offices of the Eastern Region Gas Board, at 8 p.m., on Friday, December 2nd, when the boats and yachts section will make their contribution to the series "Presenting the Society to the Society."

Hon. Secretary: W. W. RANSOM, 14, The Grange, Grange View Road, N.20.

The Junior Institution of Engineers

Friday, December 2nd, at 6.30 p.m., 39, Victoria Street, Westminster, S.W.1. Film evening. "How to Machine Aluminium"; "The Heat Treatment of Wrought Aluminium Alloys"; "Tube and Shape Bending"; introduced by D. C. G. Lees, M.A., A.I.M.

North-Western Section. Monday, December 5th, at 7 p.m., Manchester Geographical Society, 16, St. Mary's Parsonage, Manchester. Ordinary meeting. Paper, "Steam Traps," by F. Burgess. (Member.)

Midland Section. Wednesday, December 7th, at 7 p.m., James Watt Memorial Institute, Great Charles Street, Birmingham. Ordinary meeting. Paper, "Transformer Automatic Voltage Regulators by On-load Tap Charging," by G. A. P. Jewiss.

Friday, December 9th, at 6.30 p.m., 39, Victoria Street, Westminster, S.W.1. Ordinary meeting. Paper, "Some Problems of Broadcasting," by H. Bishop, B.Sc.(Eng.), A.C.G.I., M.I.E.E., A.M.I.Mech.E. (Member.)

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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